

In [14]:

```
import os
import numpy as np
import pandas as pd
import re
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfTransformer
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
```

## Question

In [2]:

```
input_files = os.listdir('SemEval2017/docsutf8')
keywords = os.listdir('SemEval2017/keys')
```

In [ ]:

```
data = pd.DataFrame()
for i in range(len(input_files)):
    with open(f'SemEval2017/docsutf8/{input_files[i]}', encoding='utf-8') as inp:
        with open(f'SemEval2017/keys/{keywords[i]}', encoding='utf-8') as key:
            text = inp.read()
            lines = key.readlines()
            keys = [line.strip() for line in lines]
            new_row = {'input': text, 'keywords': keys}
            data = data.append(new_row, ignore_index=True)
```

In [20]:

```
data.head()
```

Out[20]:

	input	keywords
0	Complex Langevin ( CL ) dynamics [ 1,2 ] provi...	[CL, complexified configuration space, Complex...
1	Nuclear theory devoted major efforts since 4 d...	[C60, combining quantum features, field of clu...
2	next important step might derivation Dirac equ...	[continuum space-time, Dirac equation, future ...
3	work shows approach based combination Statisti...	[class virial expansions, field partition func...
4	fluctuating vacuum general feature quantum fie...	[a collection of fermionic fields describing c...

## Schema of the Data

In [8]:

```
print("Schema:", data.dtypes)
print()
print("Shape=", data.shape)
```

```
Schema: input          object
keywords      object
dtype: object
```

```
Shape= (493, 2)
```

## Data Cleaning

In [10]:

```
stop_words = set(stopwords.words('english'))
```

In [17]:

```
def remove_stopwords(text):
    #new_text = ""
    word_tokens = word_tokenize(text)
    filtered_sentence = []
    filtered_sentence = [w for w in word_tokens if not w.lower() in stop_words]
    return " ".join(filtered_sentence)
```

In [19]:

```
data['input'] = data['input'].apply(remove_stopwords)
```

In [21]:

```
def pre_process(text):
    text=re.sub("</?.*?>", " <> ",text)
    text=re.sub("(\d|\W)+", " ",text)
    return text
```

In [22]:

```
data['input'] = data['input'].apply(pre_process)
```

In [23]:

```
data.head()
```

Out[23]:

	input	keywords
0	Complex Langevin CL dynamics provides approach...	[CL, complexified configuration space, Complex...
1	Nuclear theory devoted major efforts since dec...	[C60, combining quantum features, field of clu...
2	next important step might derivation Dirac equ...	[continuum space-time, Dirac equation, future ...
3	work shows approach based combination Statisti...	[class virial expansions, field partition func...
4	fluctuating vacuum general feature quantum fie...	[a collection of fermionic fields describing c...

## Creating TF-IDF

In [24]:

```
docs=data['input'].tolist() ##Creating documents
```

In [25]:

```
docs
```

Out[25]:

```
['Complex Langevin CL dynamics provides approach circumvent sign problem numerical simula
tions lattice field theories complex Boltzmann weight since rely importance sampling rece
nt years number stimulating results obtained context nonzero chemical potential lower fou
r dimensional field theories severe sign problem thermodynamic limit two recent reviews s
ee e g Refs However known since shortly inception correct results guaranteed calls improv
ed understanding relying combination analytical numerical insight recent past important r
ole played properties real positive probability distribution complexified configuration s
pace effectively sampled Langevin process clarified important conclusion distribution suf
ficiently localised order CL yield valid results Importantly insight recently also led pr
omising results nonabelian gauge theories implementation SL N C gauge cooling ',
'Nuclear theory devoted major efforts since decades describe thermalization nuclear reac
tions predominantly using semi classical methods line similar problems quantum liquids at
tempts develop improved molecular dynamics methods combining quantum features semi classi
cal treatment dynamical correlations Still clear cut quantum approach readily available y
et spite numerous formal attempts field clusters nano structures far younger fast develop
...']
```

ing relation ongoing developments lasers imaging techniques semiclassical approaches also considered field include dynamical corrections could qualitatively describe dynamical processes approaches bound simple metals sufficiently delocalized wave functions thus smooth potentials justifying semiclassical approximations case organic systems particular much celebrated C treated way Semi classical even classical approaches used high excitations delivered intense laser pulses cases system blown details quantum mechanical features matter anymore less violent scenarios quantum shell effects ignored ',

'next important step might derivation Dirac equation Creutz model suggests consider incorporating logical inference treatment additional knowledge one objects hopping lattice instead particles moving space time continuum Recall Section description measurement scenario robustness etc explicitly discrete Section continuum limit taken aim derive Pauli equation formulated continuum space time course description motion particle Section entirely within continuum description fundamental obstacle replace treatment proper treatment objects hopping lattice Therefore seems plausible logical inference approach extended describe massless spin particles moving continuum space time considering continuum limit corresponding lattice model in depth general treatment problem beyond scope present paper therefore leave interesting problem future research ',

'work shows approach based combination Statistical Mechanics nonlinear PDEs theory provides us novel powerful tool tackle phase transitions method leads solution perhaps known test case exhibits first order phase transition semi heuristically described van der Waals model particular obtained first global mean field partition function Eq system finite number particles partition function solution Klein Gordon equation reproduces van der Waals isotherms away critical region thermodynamic limit N automatically encodes Maxwell equal areas rule approach hereby presented remarkable simplicity successfully applied spin macroscopic thermodynamic systems extended include larger class models admitting partition functions form used extend critical region general equations state form including class virial expansions ',

'fluctuating vacuum general feature quantum fields free Maxwell field considered one example Fermionic fields describing electron also undergo vacuum fluctuations consequently one expects find Casimir effects associated fields whenever confined way effects first investigated context nuclear physics within so called MIT bag model nucleon bag model one envisages nucleon collection fermionic fields describing confined quarks quarks subject boundary condition surface bag represents nucleon surface electromagnetic case bag boundary condition modifies vacuum fluctuations field results appearance Casimir force force although weak macroscopic scale significant small length scales encountered nuclear physics therefore important consequences physics bag model nucleon ',

'use open close aperture Z scan experiments analogy saturation absorption work discussed earlier water respectively measure  $\beta$  n series primary alcohols help nm femtosecond laser pulses however important inclusion optical chopper vibrational combination states alcohols coupled femtosecond laser pulses nm couplings result absorption nm excited molecules undergo relaxation non radiative processes gives rise transient thermal effects transient thermal effects related pure optical nonlinearity samples measured change n values transient thermal effects individual pulses accumulate case high repetition rate lasers produce cumulative thermal effect longer timescales measure cumulative thermal effect mode mismatched two color pump probe experiment ',

'presented spectrally resolved femtosecond three pulse photon echo measurements Zn II OEP P Ni II OEP Co II OEP Increased degree freedom scans time delays allows one separate extract specific type spectroscopic information complex molecules studying spectral temporal evolution photon echo signals varying population times population relaxation dynamics inhomogeneous broadening revealed photon echo spectra Time integrated photon echo signals show two different timescales electronic relaxation timescale found sub fs whereas timescale intramolecular vibrational relaxation occurring Q band found picosecond Co II OEP Ni II OEP within picosecond Zn II OEP ',

'Water important liquid nature structure remains topic keen debate active area research Much debate centers around whether water mainly tetrahedral structure continuum distorted hydrogen bonds contains mixture two distinct components One major development recent years application inner shell spectroscopic techniques X ray absorption spectroscopy XAS X ray emission spectroscopy XES oxygen K edge investigate structure water methods provide direct structural probe water providing insight nature hydrogen bonding network Theoretical studies play critical role studies since analysis experimental data requires calculations provide link observed spectral features underlying structure However simulation XAS XES liquid water presents difficult challenge requires accurate molecular dynamics simulations provide correct description molecular structure coupled accurate calculations spectral properties i.e. excitation energies line intensities Furthermore adequate sampling molecular configurations also needs accounted ',

'experimental conditions observed dynamics occur probe laser induces reactions resulting ionization two step decay model applied explain above mentioned fragmentation DCPD CPD shown Figure a fitting rise decay components transients done Matlab programming using curve fitting Levenberg Marquardt algorithm best fit decay constants biexponential decay components C H ion signal  $\tau$  fs  $\tau$  fs C H ion signal  $\tau$  fs  $\tau$  fs respectively decay constants conform previously reported time constants norbornene norbornadiene transients reaction fragment C H sufficiently different parent ion C H indicating studying distinct dynamics neutral

is parent ion fragmentation Applying laser control principles experimental circumstances also confirms controlling product yield C H resulting photochemical reaction DCPD ',

'Experimental studies dynamics individual carbon atoms graphene empowered recent progress aberration corrected transmission electron microscopy AC TEM capable sub Ångström resolution examples include AC TEM observations formation annealing Stone Wales defects edge reconstruction formation large hole graphene sheet single vacancy defect AC TEM also exploited visualization real time process self assembly graphene nanoribbons molecular precursors formation nanometre size hollow protrusion nanotube sidewall Based AC TEM observation s transformation small finite graphene flake fullerene new top down mechanism formation fullerene electron beam radiation proposed critical step proposed top down mechanism fullerene formation creation vacancies small graphene flake result knock on damage electrons imaging electron beam e beam subsequent formation pentagons vacancy sites near edge reduce s number dangling bonds triggers curving process graphene flake closed fullerene structure Thus dynamic behaviour vacancies near graphene edge plays crucial role explaining mechanisms e beam assisted self assembly structural transformations graphene like structures '

'control RP re encounter probability finds direct application improve performance chemical devices show simple to implement control scheme highly enhances sensitivity model chemical magnetometer two orders magnitude basic idea behind chemical magnetometer since change magnetic field modifies amount singlet products one reverse reasoning measure chemical yield estimate B Intuitively magnetic sensitivity high small change magnetic field intensity produces large effects singlet yield Formally defined As B  $\Phi$ s B B pre gs B dt gs B fs B B instantaneous magnetic sensitivity functional form fs B Spel strongly depends specific realization radical pair particular number surrounding nuclear spins consider radical pair first electron spin devoid hyperfine interactions second electron spin interacts isotropically one spin nucleus e g nitrogen context chemical compass i e task determining magnetic field direction anisotropic hyperfine interactions analogous configuration one spin nucleus proposed numerically characterized optimal Additional nuclear spins would perturb intuitive reference probe picture Hamiltonian simplifies H  $\gamma$ eB S z S z  $\gamma$ e  $\alpha$ S I  $\alpha$  isotropic hyperfine coupling ',

'PESs employed already tested order verify validity dynamical purposes tests include studies nitrogen exchange reaction adiabatic running trajectories lowest surfaces non adiabatic using trajectory surface hopping TSH method transitions excited state symmetry concluded nonadiabatic transitions could make significant impact rate coefficients therefore trajectories reported independently integrated symmetry corresponding lowest adiabatic PES fact tested impact running trajectories starting upper sheets found vibrational transition take place small amounts rotational energy exchanged case Also neglected electronic transitions quartet state believed far less probable simple vibrational energy transfer studied due spin forbidden character also noted use quasiclassical trajectories justified large masses atoms involved ',

'optical properties charged excitations important understanding organic semiconductor photophysics injection electric charge organic materials polarizes surroundings changes bond lengths around excitation defined charged polaron Absorption light fluorescence quenching polarons important issues operation organic optoelectronic devices particularly relevant development electrically pumped lasers recent advances materials properties optical design lasing threshold organic structures optical pumping low enough enable pumping inorganic laser diodes LEDs promising fabrication sensitive low cost devices biosensing chemosensing However light absorption injected charges reported major obstacle electrically pumped lasing Injected charges also quench luminescence accept energy excitons resonant dipole dipole interactions important loss mechanism organic LEDs well lasers Absorption cross sections polarons known desired accuracy difficulty quantifying charge density injected film Previous studies used controlled electrical injection charges unipolar devices contacting electrodes field dependent charge mobility measurements estimate charge densities compared values obtained capacitance voltage analysis two results differed factor three ',

'Letter revisit Chesnavich model Hamiltonian light recent developments TST barrierless systems ion molecule reactions concepts OTS TTS clearly formulated terms well defined phase space geometrical objects work phase space description OTS see Refs first goal present article identification notions well defined phase space dividing surfaces attached NHIMs second main goal elucidation roaming phenomenon context Chesnavich model Hamiltonian associated potential function possessing many features associated realistic molecular PES leads dynamics clearly reveal origins roaming effect Based trajectory simulations show identification TTS OTS DSs periodic orbit dividing surfaces PODS provides natural framework analysis roaming mechanism ',

'well known optical properties atoms molecules influenced electronic environment Local field effects spontaneous emission rates within nanostructured photonic materials example familiar well summarized Optical processes including resonance energy transfer similarly dependent local environment molecular chromophores Many biological systems known contain complex organizations molecules absorption bands shifted due electronic influence nearby optical centres instance widely studied light harvesting complexes two identifiable forms photosynthetic antenna molecule bacteriochlorophyll absorption bands centred nm shown efficient forms energy transfer two occurs neighbouring carotenoid species research broader influence neighbouring off resonant molecule photon absorption mostly centred phenomenon

induced circular dichroism quantum electrodynamics QED calculations experimental procedures predict verify chiral mediator confers capacity achiral acceptor exhibit circular differential absorption ',

'Within range temperatures chosen alanine dipeptide exhibits simple behaviour result due relatively small number physically relevant minima seven characterised using force field solvent model larger potential energy spacing global minimum higher energy minima Indeed cross overs approximate global free energy minimum system free energy second lowest potential energy minimum becomes lower global potential energy minimum harmonic approximation would occur K general harmonic prediction crossover temperature two minima  $k_B T_{xo}$   $V V \ln \phi$   $v k o v k$  Eq clearly illustrates balance potential energy well entropy ',

'Since receptors human biology mostly consist chiral molecules drug action mostly involves specified enantiomeric form spurred development especially pharmaceutical industry host techniques secure enantiopure products methods mostly multi step time consuming typically cast one two distinct categories synthetic mechanisms designed produce single stereoisomer separation techniques isolate distinct enantiomers racemic mixture significant drawback either approach dependence supply enantiopure reagents substrates synthesis routes generally utilise chiral building blocks enantioselective catalysts enantiomer separation techniques typically incorporate chiral selector molecules form chemically distinct distinguishable diastereomeric complexes key requirement aiming achieve enantiopure products irrespective synthetic method therefore means measure duly quantitate enantiomeric excess signifying degree chirality within molecular products Chiral discrimination optical means well known offer direct non contact ways distinguish molecules different handedness based observations subtle differences absorption left right handed circularly polarised light indeed twisting polarisation optical rotation optical methods recent development also show promise achieve enantiomer separation introduced later ',

'methods structure solution reveal bent conformation central terthiophene units DOTT molecule clearly visible three cases Figure However fundamental difference conformation octyl side chains Whilst single crystal phase T K linearly extended chains observed Figure B defined rotation octyl chains relative terthiophene unit found three thin film phases Figure A rotation angle results twist first CC single bond link terthiophene unit octyl chain see arrows Figure A Two features rotated conformation interesting First molecule rotated side chains represents equilibrium state isolated single DOTT molecule obtained combined MD VASP calculations Second rotated conformation octyl chains allows dense packing octyl side chains molecules Interestingly single crystal structure room temperature shows twisted well linear conformation octyl side chains within one molecule Figure C ',

'Previous studies shown two main mechanisms development radiation induced DSBs  $\gamma$  ray radiation single step main process cause DSBs see Figure b attributed generation number ROS upon incident individual photon  $\gamma$  ray Whereas photo radiation causes DSBs two step mechanism Figure a reflecting single photon causes mostly single ROS thus induces single strand break second single strand break occurs near existing single strand break DSBs caused i.e. two step mechanism Summarizing results discussion may conclude significant protective effect AA photo induced damage may reflect effective diminish ROS AA  $\gamma$  ray induced DSB protective effect AA little bit weaker case photo irradiation may due generation numbers ROS single photon  $\gamma$  ray Surviving oxygen species diminishment effect AA may cause DSBs DSBs ultrasound damage caused shockwave generation cavitations Thus chemical effect AA diminish ROS considered negligibly small protection DSBs ',

'quantum dynamical method existing emerging reliable benchmarks required assess accuracy model Hamiltonian exhibiting tunnelling dynamics multidimensional asymmetric double well potential used test MP SOFT CCS methods mentioned also recently configuration interaction CI expansion method two layer version CCS L CCS Hamiltonian consists dimensional tunnelling mode coupled M dimensional harmonic bath hence system bath problem bears similarity Caldeira Leggett model tunnelling dissipative system Hamiltonian non dissipative however harmonic modes frequency System bath models play important role physics used describe superconductivity Josephson junction superconducting quantum interface device SQUID Caldeira Leggett model provides theoretical basis magnetic conductance phenomena spin bath regime '

'Three dimensional digital subtraction angiographic DSA images diagnostic cerebral angiography obtained least one day prior embolization patients raw data DSA DICOM file used creating D model target vessel segment data converted standard triangulation language STL surface data aggregation fine triangular meshes using D visualization measurement software Amira version X FEI Burlington USA unstructured computational volumetric mesh constructed triangulated surface Smoothing remeshing followed next steps STL file transferred D printer OBJET Pro Stratasys Ltd Eden Prairie MN USA resolution build layer mm D printed vessel model produced using acrylic resin Vero Following immersion water hours surface D printed model smoothed manually removing spicule ',

'situ oxidation experiments carried using mm diameter discs one surface ground polished  $\mu$ m diamond finish mm discs oxidised Philips XL FEG ESEM hot stage attachment oxidising atmosphere used laboratory air pressure Pa experiment sample observed imaged using primary beam energy kV Everhart Thornley secondary electron detector sample heated rate C min temperature C held temperature min stabilise stage microscope sample heated final temperature C heating rate total time exposure sample min cooling room temperature turning heating coils samples examined LEO VP FEGSEM chemical information gathered using EDS Cross section

ns Transmission Electron Microscope TEM samples produced using dual beam FEI Nova Nanolab Focused Ion Beam FIB milling perpendicular phase boundaries determine influence oxide development imaged using Jeol FX W filament TEM EDS maps TEM samples collected using Nanolab Scanning TEM STEM detector EDAX Genesis EDS system accelerating voltage kV ',

'study outlines trial transient response analysis full scale motorway bridge structures obtain information concerning steel concrete interface part larger study assess long term sustained benefits offered Impressed Current Cathodic Protection ICCP interruption protective current structures previously protected years ICCP system prior start study protective current interrupted order assess long term benefits provided ICCP turned paper develops examines simplified approach on site use transient response analysis discusses potential advantages technique tool assessment corrosion condition steel reinforced concrete structures ',

'results two types oxidation test combined study Table shows test matrix two approaches included h tests test conducted C performed using thermogravimetric balance TGA weight change tests monitored continually adjusted accommodate buoyancy effects tests conducted horizontal tube furnaces latter tests batches specimens placed alumina boats inserted furnaces temperature Intermittent weighing room temperature used determine oxidation kinetics selected time intervals specimen removed batch examination high temperature exposure continued remainder batch Table shows time intervals chosen examination C one isothermal test exposure time h performed date ',

'Based theoretical analysis value measuring resistor  $R_m$  effect corrosion process estimated value noise resistance order validate conclusion experiment Fig performed Specifically pair nominally identical specimens initially coupled k $\Omega$  resistor potential respect saturated calomel electrode recorded using NI USB analog to digital converter electrochemical noise signal recorded using in house developed software acquiring Hz segments points iteration iterations values acquired averaged obtain single value potential subsequently saved file used later processing final dataset comprised potential values spaced s time assumption noise present Hz negligible compared noise present Hz procedure enables accurate recording potential noise frequencies interest avoiding aliasing frequencies Hz minimizing Hz interference mains supply ',

'adhesion cohesion coating evaluated scratch test method using Revetest system CSM Instruments SA Switzerland equipped H diamond indenter  $\mu\text{m}$  diameter Six scratch indentations carried previously optimized conditions linear progressive load mode N Nmin order aid determination location spallation delamination extended scratch length mm employed scratch tracks subsequently observed SEM determine locations first coating failure understand nature coating failure scratch tests loading force penetration depth recorded respective values correlated observed failure locations surface roughness coating evaluated using surface roughness tester TR Timegroup Inc according ISO standard Due presence open porosity outer layer coating measurement length determination roughness  $R_a$  mm used total eight measurements carried different directions ',

'One surface polished cleaned using protocol designed eliminate much preparation related contamination possible follows lead surface polished hand using damp abrasive disc Buehler rMet II remove visible surface defects expose fresh metal surface Coupons polished using sequence diamond polishes decreasing particle sizes  $\mu\text{m}$   $\mu\text{m}$   $\mu\text{m}$  Buehler MetaDi polycrystalline diamond suspension polishing cloth Buehler MicroCloth saturated appropriate diamond suspension custom made jig fitted automatic polisher Buehler Minimet used hold coupons place automated polishing Coupons polished min using diamond suspension followed rinsing propanol reagent grade cleaning propanol min ultrasonic bath polishing  $\mu\text{m}$  diamond suspension coupons ultrasonically cleaned propanol min fresh propanol cleaning cycle Polished coupon s stored propanol required ',

'surfactant surface active agent work surfactant term used compounds improve dispersability CI acid emulsifiers providing dispersed emulsion separated wetting surface metallic material However surfactants offer corrosion protection examples compound used surfactant active corrosion inhibitor ingredient given Typical surfactants oilfield services industry alkylphenol ethoxylates e g nonylphenol ethoxylate NPE However NPEs banned use North Sea toxicity hand ethoxylated linear alcohols acceptable quaternary ammonium salts amines protonated used compounds cationic surfactants class cation surface active species amines function surfactant protonated state used high pH hand quaternary ammonium compounds frequently abbreviated quats pH sensitive Long chain quaternary ammonium bromides also reported work efficient CIs steel materials frequently employed surfactant N dodecylpyridinium bromide DDPB Anionic sulphates anionic sulphonates alkoxyated alkylphenol resins polyoxyethylene sorbitan oleates also useful surfactants Ali reported particularly useful surfactant blend polyethylene glycol esters fatty acids ethoxylated alkylphenols Several examples surfactants used given Section ',

'Poor oxidation behavior major barrier increased use Ti based alloys high temperature structural applications demand increase service temperature alloys beyond C typical temperature limit requires careful study understand role composition oxidation behavior Ti based alloys attempt overcome limitation Ti based alloys led production alloys substantially improved oxidation resistance  $\beta$  S also development coatings pre oxidation techniques attempting extrapolate oxidation behavior e g oxidation rate law depth oxygen ingress scale thickness observed limited number compositions certain oxidation condition broader composition al range numerous examples literature deviations expected relations observed ',

'oxide thickness calculated using weight gain surface area Artificially changing surface profile modify surface area calculated oxide thickness SEM images samples removed days oxidation used define change surface profile length variation applied roughness profile lengths extracted images used modify length sample therefore surface area Table shows original oxide thicknesses days oxidation modified oxide thicknesses based surface profile length percentage difference Results show maximum decrease oxide thickness using surface accounts roughness Comparing change oxide thickness different surface finishes indicates variation less impact variation profile length calculated oxide thickness considered insignificant addition differences weight gain due differences surface area rougher samples would expected demonstrate thicker oxides earliest stages oxidation ',

'relatively attempts observe cases extract average current density video images taken growing D pits Frankel presented method directly measure average anodic current density growing pit boundary velocity Al Al alloy Ni Fe thin films Subsequently Ryan et al determined anodic current density pits propagating D disks stainless steel thin films measuring pit edge movement velocity Ernst Newman studied stability pit growth detail measured kinetics D pit propagation depth width compared results kinetics D pencil electrodes developed semi quantitative model pit propagation explained lacy pit cover formation pit growth although measure current density within pit recently Tang Davenport tracked pit boundary movement computed instantaneous average current density Fe Co thin films However previous attempts quantify local current density inhomogeneous growth pits although local variation current density long recognised ',

'related Volta potential  $\Psi$  potential difference position infinitely far away surface position outside surface measurable quantity characterising electrochemical behaviour metal scanning Kelvin probe force microscopy SKPFM technique allows detection local EWF EWF tip known Volta potential differences  $\Delta\Psi$  atomic force microscopy tip usually Pt coated metal surface lateral resolution SKPFM high nm ambient air sensitivity meV Volta potential characteristic property metal surface used understand electrochemical processes sensitive kind surface defects chemical variations residual stress Volta potential differences microstructure used predict corrosion behaviour Regions larger  $\Delta\Psi$  indicate increased surface reactivity even correlation Volta potential differences measured nominally dry air free corrosion potential  $E_{corr}$  pre determined immersed conditions reported ',

'Anodizing processes widely used protecting aluminium alloys corrosion resultant films composed amorphous alumina consist relatively thick porous outer region thinner non porous inner region porous region contains major pores film extend film surface barrier layer Near film surface shorter incipient pores also present whose growth stopped early stages anodizing diameter major pores thickness inner barrier region dependent potential applied anodizing typical proportionalities nmV Studies ionic migration barrier type porous anodic alumina films usually found transport number 0 ions formation porous films outward migrating Al ions constituting remainder ionic current ejected electrolyte pore bases electronic current barrier region generally considered negligible thickness barrier region relatively constant growth film either constant potential constant current density maintained balance growth barrier layer continued oxidation aluminium substrate thinning barrier layer either field assisted dissolution alumina pore bases field assisted flow alumina barrier layer pore walls pores may widened toward film surface chemical dissolution extent dependent anodizing conditions ',

'Failure structural components major concern nuclear power industry represents safety issue also hazard economic performance Stress corrosion cracking SCC especially intergranular stress corrosion cracking IGSCC proved significant potential cause failures nuclear industry materials Alloy Ni Cr Fe stainless steels especially Pressurised Water Reactors PWR Stress corrosion cracking pressurized water reactors PWSCC occurs Alloy safety critical components steam generator tubes heater sleeves pressurized instrument penetrations control rod drive mechanisms Understanding mechanisms control SCC alloy allow continued extensions life current plant well safer designs future nuclear reactors ',

'Fig displays growth two main corrosion products develop from surface Cu Zn time hydrozincite Fig a Cu O Fig b remembered phases present already start exposure data presented absorbance units allows comparisons made amounts species two Cu Zn surfaces investigated DP HZ tendency clear formation rates hydrozincite cuprite quite suppressed Cu Zn preformed hydrozincite HZ compared diamond polished surface DP summary without able consider formation simonkolleite concluded increased surface coverage hydrozincite reduces initial spreading ability NaCl containing droplets thereby lowers overall formation rate hydrozincite cuprite ',

'AA T aluminium alloy widely used aerospace applications due high strength weight ratio high damage tolerance result copper magnesium principal alloying elements appropriate thermomechanical processing microstructure alloy relatively complex number compositionally distinct phases identified Although possessing favourable mechanical properties alloy relatively susceptible corrosion generally requires surface treatment practical applications corrosion behaviour alloy particularly affected presence intermetallic particles due differing potentials respect alloy matrix Copper containing second phase particles alloy surface particularly detrimental corrosion resistance provide preferential cathodic sites One principle types second phase particle important corrosion behaviour alloy phase Al CuMg particle Dealloying phase particles may account constituent particles AA alloys commonly observed alloy exposed aggressive environment particles considered important initiation sites

tes severe localized corrosion alloy dealloying phase particles resulting enrichment copper result decrease Volta potential respect matrix hence dealloyed particles become active cathodic sites ',

'key part problem inspector access data small inspected area area one minimum thickness provide enough information build model smallest thicknesses inspector generate sample smallest thickness measurements partitioning inspection data number equally sized blocks block minimum thickness recorded set forms sample smallest thickness measurements sample one build model takes account variations smallest thickness measurements Extreme value analysis is EVA provides limiting form model states underlying thickness measurements block taken independent identical distributions sample minimum thickness measurements follow generalized extreme value distribution GEVD ',

'Measuring analysing hold time CPA pill allows thermal boundary resistance within pill assessed thermal boundary dictates actual temperature CPA crystals comparison temperature cold finger maintained constant temperature servo control program Fig shows temperature profile recycling CPA pill subsequent operation mK hold time servo control program maintained CPA pill temperature within millikelvin expected microkelvin stability achieved fast read out thermometry available time testing used mKCC would allow temperature control much faster millisecond timescales current approximately s thermometry readout used ',

'product change batches others influential test results redesign upgrade nm process technology reduces pass rate LNT approximately half mainly caused increased incidence erase program timeouts contribution long erase program times bit errors difference pass rates K batches use process technology dimensions explained fabrication different assembly lines processes base materials may changed means different tolerances base materials production process pronounced lower temperature differences technology scale may reflect shifts transistor parameters transconductance gain threshold voltage threshold slope ',

'Prior assembling miniature ADR mKCC MR heat switch could fully thermally characterised due cryostat constraints However based experiments research conducted MSSL range tungsten heat switches thermal conductivity estimated Hills et al equation derived allows thermal conductivity  $\kappa$  K calculated function magnetic field B temperature see Eq estimate performance mKCC heatswitch parameters Eq taken measured thermal conductivity another MSSL heat switch mm square cross section free path length cm RRR observed experiments conducted MSS L little change thermal performance tungsten heat switches RRR subject future publication therefore performance RRR heat switch assumed good approximation Fig gives calculated thermal conductivity mKCC switch T based Eq constants b a a a a n values respectively noted calculated thermal conductivity mKCC switch presented Fig validated comparing experimental results miniature ADR modelled predictions discussed Section k b T a a T T Bna T a T ',

'early attempt combine sets networks single visualization relied first drawing Euler diagram placing graph inside however sets often visualized convoluted difficult follow curves addition limited kinds set data could shown system limited well formed Euler diagrams Compound graphs used represent restricted kinds grouped network data Graph clusters visualized transparent hulls Santamaria Theron However technique removes edges graph sufficiently sophisticated arbitrary overlapping sets Itoh et al proposed overlay pie like glyphs nodes graph encode multiple categories set hence represented using disconnected regions linked colour causes difficulties tasks involve finding relations sets T T T Section related class techniques visualize grouping information graphs using convex hulls Vizster However support visualizing set overlaps ',

'thermodynamics copper zinc alloys brass subject numerous investigations Brass characterised excess enthalpy excess entropy mixing negative enthalpic data measured solution calorimetry e g based chemical potential data calculated phase equilibrium experiments e g excess entropy mixing could evaluated e g excess entropy contains vibrational configurational parts excess vibrational entropy defined deviation entropy mechanical mixture end members B i e Smmechmix XASma XBSmB determined measuring low temperature heat capacity K versus composition behaviour determination excess configurational entropy i e excess entropy coming non random atomic distributions defects much difficult neutron scattering investigations together computer simulations normally used however reliable data total excess entropy enthalpic chemical potential data available measurement excess vibrational entropy enables determination excess configurational entropy simply subtraction Since configurational vibrational entropies may different temperature dependencies worthwhile separate entropic effects one aim study Another aim deliver experimental data first principles studies test models disordered alloy whose structural details short range order depend temperature ',

'Moreover one observes segregation effects XRD analysis probably took place high temperature partially quenched room temperature phase analysis showed three distinct phases hence distinct measurable phase transition temperature crystallise liquid surface thermograms effects observable different solidification arrest clear inflections proportion new appearing phases small therefore latent heat released new phase also small reflected light signal technique showed one phase change cooling well location segregation determined exactly molten pool later re solidified material surface temperature measured material analysis Raman spectroscopy shown signs segregation also uncertainties composition phase transition taken uncertainties XRD analysis abundant phase composition re solidified material ',

'homologous series n alkanes represented homonuclear chains tangent Mie spherical CG segments development CG models long n alkanes n decane n C H n eicosane n C H already succes



is fully demonstrated using SAFT  $\gamma$  Mie formalism  $n$  decane molecule represented chains three  $n$  eicosane chains six fully flexible tangentially bonded Mie segments certain degree parameter degeneracy terms overall performance expected consequence conformal nature EOS description current work use alternative CG mapping  $n$  alkanes developed reference segment taken represent three alkyl carbon backbone atoms corresponding hydrogen atoms applying mapping  $n$  alkanes chains containing multiples three carbon units represented directly  $n$  C H n C H n C H n C H etc good description thermodynamic properties alkanes found provided CG alkyl beads characterised Mie potential convenience exponent pair also used represent interactions CG beads intervening alkanes considered number segments taken nearest integer division carbon number  $C$  three size  $\sigma$  energy parameters estimated experimental saturated liquid density vapour pressure individual alkanes following usual SAFT  $\gamma$  Mie procedure chosen mapping means unique one postulate parameter sets fulfil requisites universal across entire homologous series correlated critical properties ',

'Myocardial electrical propagation simulated using monodomain bidomain PDEs Due capacity represent complex geometries ease approximations often obtained using finite element method FEM discretise PDEs space realistic cardiac geometry meshes results large forty million degrees freedom DOF human heart geometries systems linear equations must solved many thousands times course even short simulation Thus extremely computationally demanding presenting taxing problems even high end supercomputing resources computational demand means effort invested developing efficient solution techniques including work preconditioning parallelisation adaptivity space time study investigate potential reducing number DOF using high order polynomial FEM approximate monodomain PDE space goal significantly improving simulation efficiency piecewise linear FEM approach commonly used field schemes polynomial degree  $p$  elements adjusted according error approximation known finite element  $p$  version work presented work schemes keep  $p$  fixed ',

'work develop new approach DEA suitable modelling three dimensional problems present DEA methods rely fact one easily parametrise boundary region modelled apply orthonormal basis approximation resulting boundary phase space coordinate system two dimensions simple boundary may parametrised along arc length associated momentum direction coordinate taken tangential boundary basis suitable scaled univariate basis position momentum Fourier basis Chebyshev polynomials Defining suitable parametrisation spatial coordinate three dimensions becomes much difficult momentum space spherical polar coordinates may employed problems arise ',

'order discrete unknowns vector unknowns  $xPS \times L$  contains  $n_x$  unknown nodal coordinates followed  $n_b$  unknown discrete Lagrange multipliers linear systems solved course Newton based solution Eq subject displacement constraint saddle point structure E tangent stiffness matrix unconstrained pseudo solid problem two off diagonal blocks  $CxL \ Clx \ CxLT$  arise imposition displacement constraint Lagrange multipliers refer proof LBB stability discretisation see also discussion LBB stability Lagrange multiplier based imposition Dirichlet boundary conditions related problems note first step Newton iteration E symmetric positive definite since represents tangent stiffness matrix relative system equilibrium configuration n ',

'algorithm allows modelling plasmas arbitrary degeneracy binary collision approximation uses numerical interpolation inverse cumulative density function Fermi Dirac distribution initialise simulation particles collisions subject Pauli blocking appropriate limit strong coupling plasma theory Monte Carlo code based breaks strong coupling limit corresponds  $\ln \Lambda \ln \Lambda$  Coulomb logarithm code designed  $\ln \Lambda$  collisional plasmas non negligible level degeneracy noted Monte Carlo techniques degenerate capabilities developed studying transport semi conductors method exists fully ionised plasmas techniques described potentially applicable types codes example ParticleIn Cell PIC codes ',

'Inequality indicates maximum norm loosest among  $p$  norms Fortunately loosest constraint would seriously affect accuracy since value  $y$  comparable norm norm maximum norm provides us largest number possible solutions given error limitation would greatly enhance possibility finding group optimized coefficients scanning vast solution set hand checking maximum deviation sounds reasonable checking distance accurate approximated wave numbers since working space domain Therefore chose maximum norm criterion designing objective functions extend accurate wave number coverage widely possible ',

'Similar numerical oscillations described also emerge ISPM utilising classical IBM kernels due lack regularity discontinuous second derivatives Furthermore important remark immersed structure stresses captured Lagrangian description hence order compute accurately important ensure spurious oscillations introduced via kernel interpolation functions paper authors specifically designed new family kernel functions introduce spurious oscillations kernel functions obtained taking account discrete reproducibility conditions originally introduced Peskin case tailor made Cartesian staggered grids regularity requirements prevent appearance spurious oscillations computing derivatives Maple computer program developed obtain explicit expressions new kernels ',

'Contact methods developed used Lagrangian staggered grid hydrodynamic SGH calculations many years Early examples contact methods discussed Wilkins Cherry et al Hallquist et al provides overview multiple contact algorithms used various Lagrangian SGH codes dating back HEMP particular interest Hallquist et al describes contact surface scheme used TOODY later implemented DYNA D contact method TOODY uses master slave approach goal approach treat nodes contact surface manner similar internal node physical properties slave surface i

interpolated slave surface ghost zones using surface area weights surface area weights equal ratio ghost zone surface area surface area master surface contact surface method nodal based Lagrangian cell centered hydrodynamics CCH presented paper use surface area weights similar concept TOODY Following area fraction approach TOODY may seem retrospective however using surface area weights naturally extends new CCH methods solve Riemann like problem node zone ',

'Three Runge Kutta IMEX schemes tested Ullrich Jablonowski HEVI solution equations governing atmospheric motion tested ARS scheme Ascher et al also suggested less computationally expensive nearly accurate Strang carryover scheme involves Strang splitting first implicit stage cleverly re used final implicit stage previous time step one implicit solution per time step Another novel approach taken Ullrich Jablonowski use Rosenbrock solution order treat vertical terms implicitly rather terms involved wave propagation Rosenbrock solution one iteration Newton solver circumvents time step restriction associated vertical advection cost slowing vertical advection ',

'micro elements reach relaxed steady state measurements obtained using cumulative averaging technique reduce noise micro element divided spatially oriented bins y direction order resolve velocity shear stress profiles Velocity bin measured using Cumulative Averaging Method CAM stress tensor field measured using Irving Kirkwood relationship least squares polynomial fit data performed helps reduce noise fit produces continuous function avoids stability issues arising supplying highly fluctuating data macro solver least squares fit applied Nth order polynomial velocity profile core region Mth order polynomial velocity profile constrained region ui core k Nbk iyi N k yi hcore ui cs k Mck iyi M k yi hcs bk ck coefficients polynomials used core micro region constrained region respectively estimate new slip velocity uB input macro solution taken directly compressed wall micro element solution yi ',

'study proposes new framework numerical modelling gas exchange air water across interface subsequent chemical reaction water based extended two compartment model major purpose study provide fundamental concept modelling physicochemical processes gas exchange followed chemical reaction water Demonstrating fundamental data knowledge important environmental transport phenomena especially effects Schmidt number chemical reaction rate gas exchange mechanisms across interface also attempted gas exchange processes separated two physicochemical substeps first gas liquid equilibrium two phases second chemical reaction water phase first order irreversible chemical reaction gaseous material uptake water phase assumed simplify interactions chemical reactions turbulent transport phenomena water traditional two compartment model assumes uniform concentration material compartment present two compartment model uses computational fluid dynamics CFD technique water compartment evaluate temporal development three dimensional profiles velocity concentration fields direct numerical simulation DNS approach used evaluate profiles fluid velocities concentrations water several important turbulence statistics evaluated without using turbulent closures subgrid scale models assume fluid flow water phase well developed turbulent water layer low Reynolds number Schmidt number varied observe effects molecular diffusion gas sub interface water gas exchange rate interface Six degrees nondimensional chemical reaction rate used find effect chemical reaction rate gas exchange mechanisms Extrapolations gas exchange rates related transport phenomena toward larger Schmidt number faster chemical reaction rate also examined predict gas exchange processes actual gases Sc O based results present numerical experiments ',

'Numerical simulation gas flow non trivial internal geometries however extremely challenging conventional continuum fluid dynamics assumes locally gas close state thermodynamic equilibrium becomes invalid inaccurate smallest characteristic scale geometry e g channel height approaches mean distance molecular collisions  $\lambda$  accurate flexible modelling alternative cases direct simulation Monte Carlo method DSMC However DSMC prohibitively expensive internal flow applications typically geometry high aspect ratio i e extremely long relative cross section high aspect ratio creates formidable multiscale problem processes need resolved occurring smallest characteristic scale geometry e g channel's height well large st characteristic scale geometry e g length long channel network simultaneously ',

'Although free Kelvin wave problem considerable theoretical importance problems forcing damping greater practical importance nature forcing could due wind stress free surface astronomical tidal potential damping could due turbulent stress bottom boundary layer Regardless details forced response composed shallow water waves possibly including Kelvin wave s largest amplitudes waves natural frequency  $\omega_f$  close forcing frequency  $\omega$  various examples sort given Chapters Gill  $\omega$   $\omega_f$  large amplitude near resonant response size sensitive weak damping  $\omega$   $\omega_f$  Thus numerical solutions near resonantly forced waves anticipate errors  $\omega_f$  associated spatial discretisation could lead non trivial errors forced response ',

'test cases confirm high order discretisation retains exponential convergence properties increasing geometric expansion polynomial order solution true surface smooth Errors found saturate geometric errors due parametrisation surface elements begin dominate temporal spatial discretisation errors smooth solutions considered test cases results show dominance geometric errors quickly limits effectiveness increases number degrees freedom either mesh refinement higher solution polynomial orders Increasing order geometry parametrisation reduces geometric error analytic test cases presented use coarse curvilinear mesh applications meshes typically refined order capture features solution better capture geometry co

subsequently reduce lower bound solution error solution smooth expect see rapid convergence case solution smooth true surface exponential convergence P Pg achieved discontinuities aligned element boundaries However discontinuities lie within element convergence limited geometric approximation since true surface captured cardiac problem consider true surface solution smooth ',

'Designers microfluidic devices need computational tools used analyse problems involve rarefied gas flows complex micro geometries Numerical simulation gas flow geometries however extremely challenging Conventional continuum fluid dynamics CFD becomes invalid inaccurate characteristic scale geometry e.g channel height  $h$  approaches molecular mean free path  $\lambda$   $\lambda > h$  error solutions obtained CFD may significant must consider fluid collection interacting particles However computational expense simulating flow rarefied gas high aspect ratio micro geometries i.e ones long relative cross section using particle method direct simulation Monte Carlo DSMC method prohibitively high computational intensity particle method greater still simulating low speed microfluidic devices small deviations equilibrium characterised extremely low Mach numbers weak temperature gradients ',

'work developed simple numerical scheme based Galerkin finite element method multi term time fractional diffusion equation involves multiple Caputo fractional derivatives time complete error analysis space semidiscrete Galerkin scheme provided theory covers practically important case nonsmooth initial data right hand side analysis relies essentially new regularity results multi term time fractional diffusion equation developed fully discrete scheme based finite difference discretization Caputo fractional derivatives stability error estimate fully discrete scheme established provided solution smooth extensive numerical experiments one two dimension fully confirmed convergence analysis empirical convergence rates agree well theoretical predictions smooth nonsmooth data ',

'work light propagation scattering medium piece wise constant refractive index using radiative transport equation studied Light propagation sub domain constant refractive index modeled using RTE equations coupled using boundary conditions describing Fresnel reflection transmission phenomena interfaces sub domains resulting coupled system RTEs numerically solved using FEM proposed model tested using simulations compared solution Monte Carlo method results show coupled RTE model describes light propagation accurately comparison Monte Carlo method addition results show neglecting internal refractive index changes lead erroneous boundary measurements scattered light indicates quality DOT reconstructions could possible increased incorporating model internal refractive index changes image reconstruction procedure ',

'validity semi classical boundary conditions WTE introduced topic vivid debate especially recent works address non uniqueness symmetry properties Wigner function numerical test cases presented therein symmetric potentials provide reliable i.e well resolved results due presence singular terms steady state Wigner functions see Section recent studies demonstrate convergence WTE calculations upon increasing size simulation domain well possible improvements adapting boundary distribution physical state active device region Despite approximate nature employ inflow outflow boundary conditions well demonstrate accurate physically valid results achieved sufficiently large values  $L$   $L \gg \lambda$  Due problematics singular terms present simulations non zero bias voltages VDS  $V$  ',

'multi physics description multiscale system often referred hybrid model fluid dynamics typical hybrid combines molecular treatment micro model continuum fluid one macro model aiming obtaining accuracy former efficiency latter micro macro models generally characteristic timescales different means time accurate simulations extremely challenging size time step required make micro model stable accurate small simulations significant macro scale time periods intractable system scale separated physical distinct numerical approximation made enables coupled models advance different rates asynchronously negligible penalty macro scale accuracy Et al first introduce implement concept time stepping method coupled systems referred classification Lockerby et al continuous asynchronous CA scheme continuous since micro macro models advance without interruption paper extend idea multiscale systems comprising arbitrary number coupled models ',

'fully coupled numerical framework two phase flows implicit implementation surface tension introduced article fully coupled framework used compare influence surface tension treatment time step restrictions resulting capillary waves conducted study demonstrates restrictions numerical time step resulting capillary waves valid unchanged regardless numerical treatment surface tension Since surface tension function pressure velocity change implementation affect matrix coefficients primitive variables thus numerical stability independent treatment surface tension analysis shows capillary time step constraint requirement imposed spatiotemporal sampling capillary waves independent applied numerical methodology ',

'particular phase field model employ extension based three dimensional thermal phase field model two dimensional thermal solutal phase field model One feature physical problem purely dissipative entropy increasing natural relaxational phenomena resulting PDEs Allen Cahn Cahn Hilliard type say model involves time derivatives three fields coupled forms involving variational derivatives functional typically free energy functional dendrite growth free energy reduces monotonically time never achieves equilibrium domain boundary far dendrite Although listed difficult aspects model relaxational aspect typically asset results stable numerical schemes convection example least absence flow melt ',

'Inspired energy fueled phenomena cortical cytoskeleton flows biological morphogenesis t

theory active polar viscous gels developed theory models continuum macroscopic mechanics collection uniaxial active agents embedded viscous bulk medium internal stresses induced due dissipation energy energy consuming uniaxial polar agents constituting gel modeled unit vectors average unit vectors small local volume point defines macroscopic directionality agents described polarization field polarization field governed equation motion accounting energy consumption strain rate fluid relationship strain rate stress fluid provided constitutive equation accounts anisotropic polar agents consumption energy equations along conservation momentum provide continuum hydrodynamic description modeling active polar viscous gels energy consuming anisotropic non Newtonian fluid resulting partial differential equations governing hydrodynamics active polar viscous gels however general analytically intractable ',

'remainder discussion proceeds follows Section briefly describe problem cell tracking introduce approach cell tracking may regarded fitting mathematical model experimental image data sets present geometric evolution law model seek fit simplification recently developed models literature show good agreement experiments finish Section reformulating model phase field framework appears suitable problem hand formulate cell tracking problem PDE constrained optimisation problem Section propose algorithm resolution PDE constrained optimisation problem discuss practical aspects related implementation particular note theoretical computational framework may applied directly multi cell image data sets raw image data sets sufficient quality without segmentation Section present numerical examples case d single multi cell image data sets Finally Section present conclusions study discuss future extensions applications work ',

'boundary element method BEM clear advantages applied shape optimisation high voltage devices see introduction BEM First BEM relies surface discretisation need maintain analysis suitable volume discretisation shape optimisation process Moreover BEM ideal solving problems unbounded domains occur electrostatic field analysis gradient based shape optimisation on shape derivative cost functional respect geometry perturbations needed purpose use adjoint approach solve primary adjoint boundary value problems BEM associated linear systems equations dense acceleration technique fast multipole method necessary efficient solution recent applications fast BEM shape optimisation Bernoulli type free boundary problems refer ',

'extrapolation upwind value required TVD differencing particular hurdle application unstructured meshes discussed Section two methods extrapolate value virtual upwind node using data readily available unstructured meshes considered Given virtual upwind node incorporated gradient ratio rf extrapolation method Darwish Moukalled referred implicit extrapolation method introduced Ubbink Issa explicit extrapolation methods precisely reconstruct upwind value equidistant rectilinear meshes fail non equidistant non rectilinear meshes discussed Section Using explicit extrapolation method issue rectified imposing appropriate limits extrapolated upwind value ',

'popular choice couple set quadrature points equal number nodal Lagrange polynomials defined points leading collocation method many examples throughout literature terms traditionally utilised continuous Galerkin CG discontinuous Galerkin DG formulations well newer extensions flux reconstruction FR technique presented Huynh collocation methods linear operators exactly integrated setting depending choice quadrature integrals nonlinear terms typically incur numerical error However computational efficiencies attained use collocation formulation especially given presence diagonal mass matrix often outweigh numerical error incurred ',

'inherent problem phase space discretisation spurious separation energy discretised bins called Garden Sprinkler Effect extensively studied Boltzmann transport community known ray effect showcase effect angular dimension large spatial domain km km simulated monochromatic wave propagating long distance deep water d m spatial discretisation structured triangle mesh used element edge length km Fig initial wave field located km lower left side Gaussian distribution space significant wave height  $H_s$  m standard deviation km Fig b mean direction angular distribution  $\cos \theta$  frequency Hz simulation time dependent runs days time step s ',

'dynamics various physical phenomena movement pendulums planets water waves described variational framework development variational principles classical mechanics traces back Euler Lagrange Hamilton overview history found approach allows express dynamics system single functional Lagrangian action integral Hamiltonian mechanics reformulation Lagrangian mechanics provides convenient framework study symmetry properties system expressed Noether's theorem establishes direct connection symmetry properties Hamiltonian systems conservation laws one approximates system numerically advantageous preserve Hamiltonian structure also discrete level Given Hamiltonian systems abundant nature numerical approximation therefore topic significant relevance ',

'discussed proper inclusion interactions requires segment synchronization every iteration in order minimize simulation errors due incorrect values interactions potential segments synchronized every iteration Although relatively long communication times remote processors may hinder process typical parallel computers case GPGPU architectures Still full recalculation interaction potential iteration time consuming Instead algorithm corrects current potential adding dipole contributions every nearby charge hopped previous iteration Full updates interaction potential required grid points related charges hopped last iteration Accumulative rounding errors arise due repetitive addition subtraction solve rounding i

interaction potentials uniformly spaced range floating point numbers ',

'Multi phase flows common fact quite general environmental industrial processes Broadly may modelled continuous problems phases mixed e g oil water homogenisation sediment transport interface problems phases distinct interact interface e g gas assisted injection moulding liquid jet breakup cases flows start interface problems mixing occurs interface become effectively continuous least locally Air entrainment perhaps due wave breaking obvious example consider two phase interface problems interface remains distinct density difference high e g air water one phase may considered incompressible interface transient may become highly distorted interconnected problems tackled mesh based methods using periodic adaptive remeshing additional phase tracking functions However approaches time consuming implement prone errors surface representation mass conservation ',

'section devoted discretization advection diffusion equation analysis dispersion diffusion on eigencurves different polynomial orders spectral hp continuous Galerkin method considered closely resembles formulation presented Sec describes detail derivation semi discrete advection diffusion problem applied wave like solutions relevant eigencurves obtained inviscid case linear advection addressed Sec role primary secondary eigencurves discussed perspective introduced viscous case subsequently considered Sec eigencurves shown feature irregular oscillations problems strongly dominated either convection diffusion ',

'need represent scale interactions weather climate prediction models many decades motivated research use adaptive meshes R adaptivity mesh redistribution involves deforming mesh order vary local resolution first considered atmospheric modelling twenty years ago Dietrichmayer Droegeheimer attractive form adaptivity since involve altering mesh connectivity create load balancing problems points never created destroyed require mapping solutions meshes lead sudden changes resolution retro fitted existing models Variational methods exist attempt control resolution different directions r adaptive meshes e g Alternatively solution Monge Ampère equation generate optimally transported OT mesh based scalar valued monitor function useful form r adaptive mesh generation generates mesh equidistributed respect monitor function lead mesh tangling see optimal transport problem sphere leads slightly different equation Monge Ampère type solved numerically surface sphere would necessary weather climate prediction using r adaptivity ',

'DPD first proposed order recover properties isotropy Galilean invariance broken so called lattice gas automata method DPD body regarded coarse grained particle particles interact soft short ranged potential allowing larger integration timesteps would possible MD simultaneously decreasing number degrees freedom required Langevin dynamics thermostat consisting well balanced damping stochastic terms applied particle However unlike Langevin dynamics terms pairwise damping term based relative velocities leading conservation angular momentum linear momentum property Galilean invariance i e dependence relative velocity makes DPD profile unbiased thermostat PUT construction thus ideal thermostat nonequilibrium molecular dynamics NEMD momentum expected propagate locally global momentum conserved thus correct hydrodynamics expected DPD demonstrated previously Due aforementioned properties DPD widely used recover thermodynamic dynamical rheological properties complex fluids applications polymer solutions colloidal suspensions multiphase flows biological systems DPD compared Langevin dynamics out of equilibrium simulations polymeric systems expected correct dynamic fluctuations polymers obtained former latter ',

'Discovering vacancy interstitial defect migration pathways confined Ga free regions suggests changes recombination rates isolated vacancy interstitial pairs comparison pure Pu degree rates effected depends distribution residual defects post cascade event addition concentration ordering Ga atoms vacancies interstitials become greatly separated collision cascade pathways recombination likely become restricted recovery times extended viable cascades created vacancy rich core surrounded dispersed interstitials found low energy cascades Pu PuGa may also case channelling events energetic atoms travel deep lattice channels low atomic density ',

'simulations confirm experimental observations W net erosion represents tiny fraction simulation W gross erosion estimated upstream W fluxes FWupstream good agreement experimentally observed values m s Moreover value sensitive divertor plasma temperature low temperatures energy C ions hitting divertor plates low sputter sufficient amount W increasing energy W sputtering increases potential drop divertor plasma increases result W atoms ionized vicinity divertor return back plates two effects leading observed prompt redeposition W ions first near divertor ionization W due low ionization potential eV comparison ionization potentials C eV second W n ions large Larmor radius nmm redeposited within distance Larmor radius Important note significant fraction W ions escaping prompt redeposition returned back due friction main ions ',

'four bounding PCM wastes given Table simulated using appropriate materials geometries Mock PCM drums assembled using following components PCM drums simulated using mild steel paint cans lids Fenton Packaging Ltd PVC bags replicated using identical PVC sheeting Roma Workwear Ltd metallic waste simulated using commercial grade stainless steel aluminium copper Avus Metals Plastics Ltd lead shot Aldrich inorganic waste simulated using waste Pyrex labware crushed masonry concrete window glass CeO Acros Organics dried h C used PuO surrogate Commercially available ground granulated blast furnace slag Calumite used additive analysed chemical composition given Table Calumite powdered material typical particle size distribution limits ca  $\mu\text{m}$  ',

'still debate crystal structure composition fine oxides found ODS steels number differences

t phases proposed identified complete characterisation oxide particles including crystal structure composition needed different phases chemical variants single structure shown respond differently high temperatures irradiation Ribis de Carlan studied coarsening characteristics Y O Y Ti O oxides high temperatures show increase particle size greater non Ti containing phase Similarly Ratti et al although allude specific oxide phases shown small Ti additions Cr ODS alloy dramatically reduces coarsening rates dispersoids compared equivalent alloy without titanium example Ribis indicates coarsening rates may controlled interfacial energy secondary phase particles matrix points resistance coarsening observed Ti system probably result low interface energy would differ one phase another Whittle et al shown pyrochlore structures closely related pyrochlore structure respond different ways irradiation revealed oxide structure variations composition affect ability withstand recover irradiation induced damage ',

'displacement cascade rapid process order picoseconds migration vacancies SIAs mainly diffusion happens timescale order nanoseconds still short compared operating times important consider equilibrium result processes vacancies SIAs likely find Frenkel partner recombine annihilate metal essentially return original structure however defects instead formed large clusters single type could result formation voids dislocation loops swelling possibly weakening material process Defects trapped grain boundaries surface ODS particle effect diffusion concentration must many particles grain ',

'dashed curve represents PuO molar fraction sample surface shows following UO PuO phase boundaries rather well established compositional range see Section newly formed liquid surface initially enriched plutonium dioxide Subsequently due fast diffusion liquid phase initial sample composition x PuO tends rapidly restored however clear simulation fast cooling occurring end laser pulse leads onset solidification initial composition fully recovered liquid surface solid crust forms upon freezing total liquid mass crystallised see insets Fig double inflection cooling case corresponds solidification onset sample surface first inflection disappearance last liquid inside material second inflection highest recalculation temperature represents solidification point composition close initial one approximately x PuO current example except small segregation effects latter studied also experimentally present research post melting material characterisation ',

'vapour phase consists number different gases silicon exhibiting far higher partial pressure carbon containing species full temperature range immediate result vapour contains higher amount silicon leaving solid phase excess carbon carbon likely precipitate surface SiC grains process becomes rapid temperature approaches K Within TRISO particle SiC layer sandwiched two coatings dense carbon partial pressure thermodynamic equilibrium gaseous carbon forming graphite calculated using data taken JANAF tables added Fig showed whole temperature range relevant study vapour pressure carbon several magnitudes smaller dominant gas phases SiC ',

'second stress state tri axial tensile stress designed represent zone ahead advancing crack tip Micro scale lateral cracks observed oxide layer appear form close metal oxide interface Fig Finite element analysis Parise et al indicated cracks form result localised tensile stresses peaks metal oxide interface roughness cracks considered separate nano scale cracks might result tetragonal monoclinic phase transformation assumption made whether micro scale lateral cracks form via fracture oxide de bonding interface triaxial tensile stress state still present manufactured partially stabilised zirconia cracks would expected destabilise tetragonal phase simulated applying tensile stress direction maximum stress crack tip known applied tensile stresses cover range GPa maximum stress value GPa approximately equal three times fracture strength bulk fracture strength manufactured stabilised zirconia biaxial compressive triaxial tensile stress states trends behaviour rather absolute values considered greatest importance work ',

'Zirconium alloys used fuel cladding pressurised boiling water nuclear reactors material exposed large number environmental factors promote degradation mechanisms oxidation high burn ups i.e. extended service life oxidation associated hydrogen pick up limiting factor terms fuel efficiency safety oxidation kinetics many zirconium alloys cyclical demonstrating series approximately cubic kinetic curves separated transitions transitions typified breakdown protective character oxide potentially linked number mechanical issues Outstanding issues influence oxidation key developing full mechanistic understanding corrosion process ',

'early theoretical work Catlow assessed number Willis type clusters found stable using potential based methods recently split interstitial type clusters Fig emerged computational studies stable species following potential based investigation Govers et al found cluster UO supercell relaxed split di interstitial Fig b single VO three Oi displaced approximately Å directions VO result later confirmed LSDA U calculations Geng et al family split interstitial clusters extended include tri interstitials di interstitial fourth Oi site occupied quad interstitials two di interstitials adjacent sites giving total two VO six Oi Fig Following Andersson et al postulated model U O based UO supercell containing multiple split quad interstitial clusters following prediction LSDA U calculations quad interstitial stable cuboctahedral counterpart ',

'formulation Table derived empirical approach led non classical glass matrix Carter et al Zhang et al took systematic approach glass ceramic wasteforms wasteforms targeted Hanford K basin sludges immobilisation primary waste stream production molybdenum Australian Nuclear Science Technology Organisation site Sydney respectively work Carter et al Zhang et

to all intended crystalline phase closely related titanate pyrochlorite  $\text{CaTiO}_3$  glass matrix formulated trivalent species glass network boron aluminium charge compensated molar basis sodium stoichiometric composition glass wasteform  $\text{NaAlBSiO}_3$  glass provides method glass composition varied systematically Given initial observations inferred important role played alumina decided prepare suite zirconolite glass ceramics glass matrix defined  $\text{NaAl}_x\text{BSi}_{1-x}\text{O}_3$  investigate role played glass composition controlling crystalline phase stability x end member gives mineral albite  $\text{NaAlSi}_3\text{O}_8$  melting point albite Composition cools glass cooling rates occur HIP cycle available phase diagrams boron analogue albite shown liquidus estimated relevant phase diagram C phase diagrams quaternary system  $\text{Na}-\text{O}-\text{Al}-\text{O}-\text{B}-\text{O}-\text{SiO}_2$  could found ',

'calculations formation energy box size set a a a a bcc Fe lattice parameter calculation s periodic boundary conditions constant volume used Monte Carlo algorithm used determine lowest energy configuration cluster organised follows First energetics voids without helium investigated vacancy introduced simulation cell system minimised using conjugate gradient algorithm yielding single vacancy formation energy  $E_{\text{vac}}$  eV Next atom highest potential energy removed system system minimised scheme iteratively continued create voids number target vacancies formation energy calculated Next helium atoms introduced vacancies total system energy measured recorded point Metropolis MC scheme used find low energy configurations Every helium system randomly displaced site maximum  $r_{\text{max}}$  Å cut distance He He interactions x z directions minimised using conjugate gradient algorithm bubble continued minimum steps searches terminated system energy drop within steps schematic iterative process shown Fig ',

'class steels known oxide dispersion strengthened ODS ferritic alloys also known nanostructured ferritic alloys consist dispersion ultra fine oxide particles throughout matrix oxide particles serve improve mechanical properties system particularly high temperatures system inhibiting dislocation motion grain boundary sliding nuclear applications oxide particles suggested act point defect sinks improve radiation tolerance preferential sites formation nano scale bubbles therefore reducing swelling compared non ODS steels ability oxide particles improve properties depends structure composition particles stability irradiation Typical compositions ODS steels include at Cr oxidation resistance commonly at W solid solution hardening Y O put solid solution initial mechanical alloying process consolidation high temperatures forms precipitates Ti inhibit significant growth oxide particles balance made Fe impurities reason steels often referred YWT reflecting constituent elements ',

'Structural properties well reproduced models Table significant improvement potential standards elastic constants relate system responds stress Indeed structure elasticity important parameters elucidating grain boundary stability potential models correctly predict relative stability defect energies Morelon potential model performed best specifically derived replicate defect formation energies largely underestimates bulk modulus energies calculated Morl Arima potential models overestimated known disadvantage using rigid ion models ionic polarisability taken account completeness report two shell models best results given Catlow potential model Morl along Grimes shell potential model accurately reproduce activation energy oxygen migration migration path lowest energy favourable diffusion mechanism observed bulk  $\text{UO}_2$  major deficiency Morl potential cation defect energies high hence number cation defects underestimated However issue unless model applied processes grain growth cation mobility contribute ',

'Zirconium alloys used cladding encapsulate fuel pellets pressurised boiling water nuclear reactors Research oxidation alloys significant since introduction material However microstructure electro chemical processes oxidation complex many questions still remain unanswered One issue formation lateral cracks near metal oxide interface Small cracks seen form continuously oxidation large scale networks lateral cracks forming cyclically every  $\mu\text{m}$  oxide growth networks cracks correlated acceleration corrosion kinetics lateral cracks might enable link nano pores along grain boundaries perpendicular metal oxide interface reported Experiments using Synchrotron X Ray Diffraction S XRD Polatidis et al Petigny et al separately shown oxides formed Zircaloy composed monoclinic stabilised tetragonal phases reduction tetragonal phase fraction  $\mu\text{m}$  oxide growth One theory lateral cracks may destabilise tetragonal phase close metal oxide interface phase transformation expansion associated could lead fracture perpendicular metal oxide interface thereby generating fast ingress routes oxygen containing species ',

'Hydrides precipitated zirconium degrade mechanical properties component leading reductions tensile strength ductility fracture toughness changes ultimately compromise integrity cladding normal operating life accident conditions fuel storage well degradation mechanical properties presence hydrides also affect phenomena like pellet cladding mechanical interaction PCMI introduce mechanisms failure delayed hydride cracking DHC former mechanism product thermal expansion fuel pellets introducing stresses cladding may lead formation cracks areas made brittle large hydride concentrations latter mechanism DHC sub critical time dependent cracking phenomenon requires long range hydrogen diffusion repeated local hydride growth fracture hydrostatic tensile stress raiser process occurs extended period time continuously applied load yield stress material ',

'Spark plasma sintering SPS relatively new sintering based technique powder consolidated loaded electrically thermally conductive graphite mould large DC pulsed current A applied uniaxial pressure current passes graphite mould powder electrically conductive powder heated

ted outside mould acts heating element inside due Joule heating intrinsic electrical resistance powder material SPS characterised fast heating C min cooling rates short holding times minutes achieve near theoretical density Thus SPS occupies different time temperature density space powder consolidation maps compared conventional methods hot pressing sintering HIP ramp rate C min hours holding time Although SPS studied rapidly growing number materials small number studies fabrication microstructural characterisation ODS steels processed SPS briefly reviewed ',

'conclude electrochemical reduction uranium dioxide uranium metal studied lithium chloride potassium chloride eutectic molten salt C electrochemical synchrotron X ray techniques utilised deduce electrochemical reduction potential mechanism reduction pathway electrochemical reduction potential UO<sub>2</sub>/U couple dependent activity oxide ions existing within melt electrochemical reduction uranium dioxide uranium metal seems occur single electron step process indicated single reduction peak C cyclic voltammograms also exclusion phases EDX data electrochemical reduction may impeded increase oxo acidity molten salt O<sup>2-</sup> ions liberated electroreduction may react counter electrode thus removed molten salt could due electrode geometry and or inherent microstructure working electrode high tortuosity example would impede diffusion O<sup>2-</sup> ions working electrode could cause increase activity oxide ions existing within melt hence inhibit electrochemical reduction exploration microstructure working electrodes focus future work ',

'primary benefit using D model allows application anisotropic material properties hexagonal close packed lattice structure single zirconium grain plastically anisotropic due difficulty activating slip c component Abaqus allows represented setting plasticity potential ratios anisotropic elastic plastic constants shown Table Zirconium alloys often bimodal basal pole distribution tilt basal normal c direction normal direction quoted recrystallized Zircaloy However simplicity basal normal c direction taken parallel normal direction directions Table correlate X Z global coordinate system D simulations direction correlating c direction zirconium unit lattice Table also shows elastic properties incorporated simulations oxide layer simulated purely elastic material Although known oxide strongly textured still simulated homogenous solid therefore isotropic material properties used oxide simulations ',

'Zirconium alloys commonly used fuel cladding water cooled nuclear fission reactors mainly due low neutron cross section good corrosion resistance normal operating conditions sufficient mechanical strength Despite high corrosion resistance normal operating temperatures around C Zr alloys oxidise rapidly exposed temperatures hundred degrees higher exothermic reaction accelerate oxidation temperatures beyond C potentially lead disintegration fuel rods highlighted Fukushima Daiichi nuclear accident reason new research activities initiated worldwide develop accident tolerant fuels ATF Additionally ATFs could also provide enhancements corrosion performance normal operating conditions enabling development fuel assemblies high burn up ',

'studies association transition lateral cracking oxide layer depicts interaction mechanical behaviour system corrosion kinetics provide clear understanding morphology metal oxide interface corrosion process nanometre level Understanding transition behaviour happens critical modelling rate growth oxide therefore lifetime prediction Zr clads ultimately safety nuclear power reactors model complete without nanoscale understanding going oxidation Thus essential oxide scale top layers metal studied nanometre resolution reveal detailed structural chemical changes associated diffusion oxygen resulting oxidation metal Whilst number techniques employed purpose clear various techniques within transmission electron microscopy TEM among versatile informative purpose although additional information added techniques atom probe tomography ',

'Solid pieces mg used measure enthalpy increments using Setaram Multi detector High Temperature Calorimeter MDHTC using drop detector details technique refer previous studies measurements carried argon atmosphere oxygen content ppm using pure platinum ingots mg purity reference material temperature range experiment K K using steps K isothermal run consisted drops Bi<sub>2</sub>O<sub>3</sub> samples surrounded two drops platinum sensitivity device determined drops separated time intervals min long enough re stabilize monitored heat flow signal Background subtraction peak integration performed using commercially available software data processing reported temperatures corrected accordance calibration curve obtained prior measurement using several high purity standard metals Sn Pb Zn Al Ag Ni various melting temperatures order cover whole temperature range measurement drop calorimetric measurements maximum considered temperature material subjected new XRD measurement confirming stability compound experimental conditions ',

'fluence capsule determined using activation monitor sets monitor sets consist different metal wire pieces activation reaction specific energy range different activation energies chosen way spectrum reconstructed BODEX capsule contained flux monitor set back side seen core one front side positioned central height capsules Additionally one detector placed top one bottom resulting total monitor sets per leg fluence capsule determined average two flux monitor located capsule sets analysed determining activation wire piece indicates fluence specific energy range Table show values fluences two capsules containing molybdenum ',

'Uranium carbide traditionally used fuel kernel US version pebble bed reactors opposed German version based uranium dioxide Generation IV nuclear systems mixed uranium plutonium carbides U-Pu-C constitute primary option gas fast reactors GFR UCO first candidate high



temperature reactor VHTR former case fuel high actinide density thermal conductivity exploited view high burnup performance latter UO<sub>2</sub> good compromise oxides carbides terms thermal conductivity fissile density However American VHTR design fuel ratio UO<sub>2</sub> UC one essential reason well explained Olander recent publication burnup pure UO<sub>2</sub> fuel tends oxidize UO<sub>2</sub> x UO<sub>2</sub> x reacts pyrocarbon coating layer according equilibrium UO<sub>2</sub> x xC UO<sub>2</sub> xCO',

'Following fission noble gas atoms distributed fuel matrix initially accommodated point defects trap sites generally thought Schottky trivacancy defects Diffusion either bubbles grain boundaries facilitated associating uranium vacancy defect gas atom hop original vacancy able loop around ensure continued diffusion rate determining step process migration Xe rather rearrangement VU defect facilitate net Xe diffusion Activation energies overall process depend availability defect trap sites turn depends crystal stoichiometry Xe diffusion UO<sub>2</sub> x UO<sub>2</sub> UO<sub>2</sub> x activation energies calculated using DFT eV eV eV ranges reflecting way calculations performed depending charge states defects involved presence Jahn Teller distortion Activation energies calculated using empirical pair potentials vary strongly depending choice potential Govers et al examined three different potentials UO<sub>2</sub> Basak Jackson Morelon coupled different parameterisations U Xe O Xe interactions Geng Nicoll recommend values eV eV eV different stoichiometric regimes good agreement experimental values eV eV eV respectively ',

'Ferritic martensitic steels candidate materials use nuclear reactors transmutation created inert gas especially plays important role microstructural evolution steels neutron irradiation previous paper mechanisms perfect body centred cubic bcc Fe lattice agglomerate bubbles discussed shown small interstitial clusters highly mobile become effectively pinned emission Fe interstitials clusters contain atoms Small bubbles around nm diameter easily form room temperature seed points larger bubbles difficult form diffusion alone due induced strain bcc lattice increases energy barriers diffusion towards bubbles whilst reducing direction away bubbles Subsequent bubble enlargement occur either increased temperature radiation induced mechanisms increase number vacancies bubble reduce lattice strain Emission interracial loops bubble observed molecular dynamics simulations ',

'Magnox reactors represent first generation gas cooled reactors UK used carbon dioxide CO<sub>2</sub> primary coolant honeycomb network graphite bricks provide neutron moderation reactor operation significant amounts carbon monoxide CO produced CO coolant CO turn radiolytically polymerised form carbonaceous deposit free surfaces non graphitic carbon deposit significantly chemically reactive air underlying graphite lifetime Magnox reactors small quantities methane gas injected coolant gas inhibit weight loss graphite core due radiolytic oxidation Methane CH<sub>4</sub> precursor carbonaceous deposits form sacrificial layer protecting underlying graphite excessive weight loss reduction mechanical strength assumed nitrogen incorporation deposit formation subsequent production route high C levels observed ',

'essential part nuclear reactor analysis prediction three dimensional space time kinetic s neutrons relatively large finite heterogeneous three dimensional reactor core majority safety analyses prediction reactor physics responses performed using neutron diffusion theory applied three dimensional systems inputs usually derived deterministic neutron transport solutions two dimensional lattice geometries increased activity related uncertainty sensitivity reactor physics calculations Organization Economic Cooperation Development Nuclear Energy Agency OECD NEA sponsored ongoing benchmark entitled Uncertainty Analysis Modelling UAM related efforts goal work offer strategy computing lattice sensitivities using DRAGON lattice code WIMS D multi group library Results presented comparison TSUNAMI developed Oak Ridge National Laboratories ',

'increase neutron leakage core region achieved modifications core geometry usually adopting pancake geometry active core region expense general neutron economy Extensive studies determined set core design modifications optimised total sodium void reactivity becoming less positive Among efficient design solutions identified enlarged sodium plenum active core region combination absorber layer sodium plenum reduce neutron backscattering reflector region plenum Fig shows combined effect different upper plenum thicknesses absorber boron layers observed sequential increase layer s thickness converge asymptotic value reactivity reduction slightly pcm pair values selected cm sodium plenum cm boron layer modifications implied considerable increase sub assembly length compensated reducing upper axial reflector width Sun et al ',

'pipes pressure RCS connected RCS usually made austenitic austenitic ferritic stainless steel connections welded pipes may exposed various degradation phenomena diverse hazards mechanical fatigue thermal fatigue stress corrosion etc Event screening databases showed total events related cracks leaks Three main causes failure identified namely fatigue corrosion presence manufacturing defects Human factor induced defects proved little impact less cases could attributed operation errors Fatigue found induced several factors excessive vibration pressure shocks thermal regime operating pipe well combinations factors Corrosion induced cases non appropriate choice alloys taking account chemical parameters fluid inside pipes Manufacturing defects mostly dealt welding related problems deviation design documentation post weld heat treatment ',

'design temperature reached sample holders guarantees Na remains liquid operation improve heating transfer avoiding solid formation cold working temperature sodium boiling hot working temperature temperature Na surface monitored six dedicated thermocouples order prevent oxidation Na plenum containment filled high purity MPa sealed final assembly kept closed in pile operation gas circulation containment heat generated fission gamma absorption

radiation materials radially dissipated Na bath structural materials gas gaps conduction radiation downstream primary coolant TRIO wet channel ',

'Geomagnetic jerks conspicuous yet poorly understood phenomena Earth magnetic field motivating investigations morphology theory behind origins Jerks commonly defined observed form single observatory V shapes single component geomagnetic secular variation SV first time derivative main magnetic field MF times gradient changes separate linear trends several years associated step changes second time derivative MF secular acceleration SA impulse s third time derivative V shape SV definition jerks includes implicit expectation large magnitude step change gradient without definition scale threshold value basic need observable data highly variable background noise Jerks described amplitude difference gradients two linear SV segments jerk A a a a gradient jerk a gradient jerk measure essentially best fit SA change across jerk Jerk amplitude thus positive positive step SA negative negative step consider spatial extent definition refer individual features one field component given observatory time series single jerk ',

'Seismic tomography powerful tool investigate deep structure volcanoes recently rapid development Chinese provincial seismic networks Zheng et al portable seismic arrays Hetland et al Duan et al Lei et al b around volcanoes become possible image detailed D velocity structure volcanoes seismic stations densely spaced overview synthesize results deep seismic images upper mantle Changbaishan Tengchong Hainan volcanoes well Datong volcano Fig also evaluate advantages recently updated seismic tomographic techniques deriving potential information work updates previous review Zhao Liu topic detailed synthesis available information ',

'Copper catalyzed Huisgen cycloadditions recently extensively studied polymer chemists synthesis functional polymers either end functional side functional post functionalization synthetic polymers important feature macromolecular engineering many polymerization mechanisms rather sensitive presence bulky functional groups example wide variety telechelic polymers i e polymers defined chain ends efficiently prepared using combination atom transfer radical polymerization ATRP CuAAC strategy independently reported early van Hest Opst een Lutz et al Matyjaszewski et al step important since ATRP popular polymerization method modern materials science Indeed ATRP facile technique allows preparation well defined polymers narrow molecular weight distribution predictable chain length controlled microstructure defined chain ends controlled architecture However range possibilities ATRP broadened CuAAC instance  $\omega$  bromine chain ends polymers prepared ATRP transformed azides nucleophilic substitution subsequently reacted functional alkynes Scheme Due high chemoselectivity CuAAC method highly modular may used synthesize wide range  $\omega$  functional polymers Moreover formed triazole rings passive spacers interesting functions exhibiting H bonds capability aromaticity rigidity ',

'viscoelastic behavior elastomers containing small amounts unattached chains investigate and characterize dynamics polymer chains trapped fixed networks Polymer chains trapped fixed networks constitute simpler system study polymer chain dynamics corresponding uncrosslinked polymer melts complicated effect motion surrounding chains dynamics probe chain called constraint release absent fixed network systems earlier studies employed randomly crosslinked elastomers host networks case precise control mesh size host networks possible mesh size broad distribution end linking systems give host networks uniform mesh size control mesh size size precursor chains investigated dynamic viscoelasticity end linked PDMS elastomers containing unattached linear PDMS functions size unattached chains Mg network mesh Mx Fig a employed two types host networks Mx Mx Mx networks designated NL NS respectively designed end linking long Mn short precursor chains Mn respectively mesh NL networks dominated trapped entanglements NS network governed chemical cross links ',

'Microhardness related macroscopic mechanical properties yield stress  $\sigma$  elastic modulus E derived compression testing work hardened metals Tabor derived direct proportionality hardness compressive yield stress H  $\sigma$  However soon realized Tabor's relationship applies materials exhibit full plasticity Deviations relationship reported number metals glasses polymers elastic strains non negligible Hence different expressions describing correlation hardness conventional macroscopic mechanical properties rely validity above mentioned elastoplastic models way hardness yield stress longer hold direct proportionality relationship depends specific material properties Poisson's ratio elastic modulus shown elastoplastic models satisfactorily explain H  $\sigma$  ratio number polyethylene materials different nature also theoretically account range H E ratios experimentally determined ',

' morphological studies multi component polymeric materials carried various microscopic scattering methods Optical microscopes transmission electron microscopes TEMs scanning electron microscopes SEMs atomic force microscopes AFMs commercially available widely used biggest advantage microscopy provide intuitive real space representations various morphologies However comes measurements especially quantitative way microscopy sometimes lacks statistical accuracy due small field view contrast scattering methods provide much superior statistical accuracy microscopy simply observation volume larger microscopes One must remember however scattering methods normally require hypothesized models data analysis advance provide intuitive insight morphologies microscopy complete characterization specific morphology one may need first know morphologies microscopy subsequently evaluate structural parameters scattering basis morphology two methods complementary ',

'deal intensity scattered random mixture deuterated hydrogenated PE chains algorithm used to evaluate Kratky plots sets parallel polymer stems simplified checked adequate reciprocal scattering conditions ',

local coordinate range investigation  $q \sin \theta / \lambda$  comparing results precise calculations scattering centres identified pseudo atoms repeating constant distance  $\Delta$  along straight lines coinciding stem axes scattering centres placed stem scattering atoms belonging chain folds neglected parallel stem axes disposed according hexagonal setting rough approximation monoclinic pseudo hexagonal structure PE scattering centres axial coordinates stems Defining integer going total number  $n_s$  scattering centres  $q_A q_I q_C b_H b_D i n_s j n_s n_q \sin q_{dij} d_{ij} d_{ij} d_{ij} \Delta_{ij} z_j z_i q n \sin \theta / \lambda$  where  $b_H b_D$  respectively scattering lengths hydrogen deuterium  $d_{ij}$  distance C atoms  $\theta$  diffraction angle  $\lambda$  wavelength  $i$  th C atom coordinate along stem axis  $z_i \Delta_{ij}$  distance stem axes atoms  $j$  belong stems set  $z_i$  coordinates sum Eq A extended stems crystalline domain see Figs examples ',

'incompatible three component polymer chains tethered junction point resultant star molecules ABC type frustrated field bulk junction points aligned two dimensional planes one dimensional lines schematically shown Fig Furthermore chain length difference large array junction points tends straight long one Consequently domain mesoscopic sizes becomes cylinders cross sections could conformed polygons three interfaces A B B C C A likely flat since exist junction points interfaces therefore chain entropy contribution free energy structure formation considerably small comparing regular block graft copolymer systems matter fact Dotera predicted several tiling patterns diagonal bond method new Monte Carlo Simulation Gemma Dotera pointed three regular tilings i.e. permitted three branched molecules proposed even polygon theorem ',

'ever increasing computer performance simulations much larger systems become feasible However full atomistic approaches polymer crystallization need extremely large computer power even case simple polymers appropriate modeling coarse graining system imperative series work development coarse grained models polymers Mayer Muller Plathe build model poly vinyl alcohol PVA studying early stage crystallization investigated emergence crystalline order isotropic melt rapid quenching could reproduce many elementary processes homogenous nucleation showed good correspondence experiments simulations temperature dependence lamella thickness structure fold surface etc work neglected long range force van der Waals attraction accelerate computation model energy contribution due intrachain interactions dominant driving force crystallization entropic seems ignore dominant driving force polymer crystallization conventional sense However work reminiscent classical solid liquid transition systems repulsive spherical atoms poses intriguing problem intrinsic driving force polymer crystallization ',

'living polymerization reaction without transfer termination reactions proceed complete monomer conversion addition initiation quantitative fast compared propagation reaction polymers precisely controlled chain length narrow molar mass distribution obtained case industrial styrene polymerization would permit avoid specific washing degassing steps necessary radical process remove residual monomer low molar mass oligomers Since head to head effects along chains absent anionic polystyrene would exhibit also better thermal stability radical one Therefore production anionic polystyrene PS would interest conditions required control polymerization could adapted market able compete economically industrial radical processes use organic solvents expensive alkyl lithium initiators well relatively low reaction temperatures required important limitation overcome possibilities achieve quantitative living like anionic polymerization styrene absence solvent elevated temperature using inexpensive initiating systems main targets identified tremendously decrease cost anionic process implied first control reactivity stability initiating propagating active species unusual operating conditions ',

'SPM AFM particular widely applied questions polymer crystallization technique several strengths make ideally suited studies high resolution technology routinely resolving sub nm features hence allowing fundamental length scale polymer lamellar crystal thickness observed AFM requires staining metal coating sample sample preparation relatively straightforward Also non destructive many circumstances allows images obtained process crystal growth melting occurring giving time resolved data lamellar sub lamellar resolution final feature provides many exciting possibilities AFM studying polymer crystallization possible watch crystal growth crystal melting re organisations within crystals lamellar scale seeing structure evolves local conditions influence kinetics AFM wide range different measuring modes ever increasing number functional semicrystalline polymers available e.g. breadth experiments carried single machine also one techniques attractions ',

'hydroxyl functionalized poly butylene succinate based polyester prepared conventional polycondensation benzyl protected dimethyl malonate butanediol Scheme a Yao et al reported direct polycondensation l lactic acid citric acid formation poly l lactic acid co citric acid obtaining polyester oligomer pendant carboxylic hydroxyl groups b PLCA oligomer reacted dihydroxylated PLLA macromonomer yielding PLCA PLLA multiblock copolymer shown Scheme b lipases investigated ring opening polymerization ROP cyclic ester monomers also used preparation polyesters polycondensation reactions advantage technique enzyme catalyzed reactions proceed without protection pendant functional groups field hydroxyl bearing polyesters synthesized copolymerization divinyl adipate various triols e.g. glycerol butanetriol represented Scheme c copolymerizations octanediol adipic acid several alditols recently several  $\alpha$  hydroxy acids derived amino acids homo copolymerized lactic acid polycondensation bulk without protected monomers Scheme Biodegradable polyesters various pendant groups obtained although molecular weights remained low g/mol ',

'Inverse miniemulsion polymerization water in oil W/O heterogeneous polymerization process

ss forms kinetically stable macroemulsions around critical micellar concentration CMC process contains aqueous droplets including water soluble monomers stably dispersed aid oil soluble surfactants continuous organic medium Stable inverse miniemulsions formed high shear either homogenizer high speed mechanical stirrer Oil soluble nonionic surfactants hydrophilic lipophilic balance HLB value around used implement colloidal stability resulting inverse emulsion Upon addition radical initiators polymerization occurs within aqueous droplets producing colloidal particles Fig Several reports demonstrated preparation stable particles hydrophilic water soluble polymers polyaniline nanoparticles organic inorganic hybrid particles method also allows preparation crosslinked microgels presence difunctional crosslinkers addition CRP techniques including ATRP RAFT inverse miniemulsion explored prepare well defined nanoparticles nanogels ',

'contrast polymers typically synthesized liquid phase SWNTs produced variety synthesis techniques typically involve reaction gaseous carbon feedstock form nanotubes catalyst particles MWNTs first observed arc discharge fullerene reactors technique later adapted produce SWNTs Similarly fullerene production method laser ablation adapted produce SWNTs nm diameter larger quantities metal catalyst particles number chemical vapor deposition CVD processes developed grow SWNTs MWNTs involving reaction gaseous carbon compound feedstock processes include fluidized bed carpet growth carbon nanotubes CNTs catalyst particles embedded substrate shown Fig catalytic gas flow CVD One effective cheap scalable CVD techniques HiPco high pressure CO process use pre formed catalyst particles unlike CVD techniques ',

'ELRs particularly attractive synthesis block copolymers self assemble polymer nanostructures micelles first work area involved elastin mimetic di block copolymer containing VPG EG IPGAG VPGFG IPGVG hydrophilic hydrophobic blocks respectively resulting micelles studied dynamic light scattering DLS DSC used measure enthalpy self assembly tri block copolymer subsequently synthesized TEM images polymer showed formed spherical aggregates multivalent spherical micelles obtained linear elastin like AB di block copolymers temperature range C aim targeting cancer cells Bidwell et al also exploited ELRs ability serve macromolecular carriers thermally targeted delivery drugs Attachment doxorubicin ELR based system showed enhanced cytotoxicity uterine sarcoma cells aggregation induced hyperthermia ',

'general ion exchange capacity IEC closely related proton conductivity PEMs acid functionalities sulfonic acid groups contribute proton conduction membrane Beyond certain sulfonation degree PEMs tend absorb much water even soluble water negatively affect mechanical resistance water resistance Therefore improvement proton conductivity using aromatic polymers moderately adjusted IEC values intense investigation achieve high proton conductivity moderate IEC values formation ion channel structures enable effective proton conduction studied course studies ideal morphology pursued microphase separation segmented block copolymers hydrophilic sulfonated polymer segments form interconnected three dimensional network responsible efficient proton transport complementary network hydrophobic non sulfonated segments imparts reinforcing effect preventing excessive swelling water enhancing mechanical properties image ideal morphology PEMs shown Fig ',

'general point view polymerization techniques divided two types chemical reactions step growth polymerization free radical polymerization Step growth polymerization widely used synthesis polyesters polyamide epoxies synthesis polyacrylics requires use free radical polymerization polymerization reactions performed either bulk solution dispersed media Heterophase polymerizations i.e. emulsion dispersion miniemulsion polymerizations present advantage easier removal resulting product reactor compared bulk polymerization thanks low viscosity reaction medium Polymerization solution also induces lower viscosity also lower reaction rates due dilution reactants higher cost environmental impact due use organic solvents problems solved case heterophase polymerizations reactants confined inside droplets dilution effect water used medium use surfactant molecules usually needed stabilization monomer droplet subsequent polymer particles water phase ',

'Despite loss directed self complementary hydrogen bonding alkylation imidazole ring electrostatic aggregation imidazolium salts tunable self assembly process instrumental several applications Imidazolium salts used extract metal ions aqueous solutions coat metal nanoparticles dissolve carbohydrates create polyelectrolyte brushes surfaces example atom transfer radical polymerization ATRP used graft poly ethyl methacryloyloxy ethyl imidazolium chloride brushes onto gold surfaces One imidazolium salt promising attributes antimicrobial action molecular self assembly liquid crystals Alkyl methylimidazolium chlorides bromides alkyl methyl hydroxyethylimidazolium chlorides N alkyl N hydroxyethylpyrrolidinium example exhibit strong biocidal activity Hydrogels form polymerized methylimidazolium based ionic liquids acryloyl groups polymer self assembles organized lamellae unique swelling properties leading bioactive applications bioactive applications imidazolium salts include antiarrhythmics anti metastatic agents imidazolium based steroids Separation applications include efficient absorption CO Imidazolium salts enhance vesicle formation imidazolium surfactants also find application polymeric actuators ',

'Note quantitative introduction reactive functionality polymer chain end easily achieved adopting living ROMP technique especially using Schrock type molybdenum alkylidene initiator exclusive preparation end functionalized ring opened polymers realized living polymerization quantitative initiation applied prepare block copolymers ABCs coupled another living polymerization techniques also preparation macromonomers described contrast initiation efficiency always perfect seen molybdenum alkylidene initiators dissociation ligand PR

etc required generate catalytically active species ROMP ruthenium carbene catalysts Scheme equilibrium coordination dissociation PR present even propagation process replacement halogen anionic ligand and or replacement PR neutral donor ligands substrates also considered probable side reactions Importance using molybdenum catalysts thus emphasized precise preparations although initiators highly sensitive moisture monomers solvent thus strictly purified avoid catalyst decomposition deactivation ',

'application ROMP derived random copolymers covalent incorporation optical sensor moieties polymer matrix ROM polymers tested matrix materials oxygen sensing phosphorescent complex platinum tetrakis pentafluorophenyl porphyrin correlation nature ROM polymer side chain optical response sensor molecules established Several works dedicated synthesis ROM available optical sensor molecules phenantroimidazoles europium complexes xanthene dyes random copolymerization evaluation sensing profiles copolymers Another application comprises random copolymers covalently bound eosin and or ethyl dimethylamino benzoate units tested macroinitiators photopolymerization acrylates aiming initiator coininitiator system combines good polymerization activity improved migration stability ',

'Another choice graft fluorinated groups copolymers functional groups Casazza et al synthesized acrylic terpolymer pendent perfluoroether segments via grafting fluorinated groups poly butyl methacrylate co hydroxyethyl acrylate co ethyl acrylate random copolymer hexamethylene diisocyanate functionality Malshe et al studied coating properties fluorinated acrylic copolymers based MMA BA hydroxyethyl methacrylate HEMA partially esterified hydroxyl functionality HEMA tetrafluoro propanoic acid cured polymer butylated melamine formaldehyde resin methods suited synthesis copolymers containing complicated fluorinated groups difficult provided directly living polymerization ',

'Assuming constant cell electrical conversion efficiency constant fraction incident solar radiation would dissipated solar cell solar radiation intensity level Table seen worst scenario ambient temperature  $C$  natural convection predicted cell electrical conversion efficiency would reduced approximately rather assumed energy dissipated heat cell would thus higher correct effect apparent insolation level modified using following formula  $I_{act} = I_{dn} \eta$  where  $I_{act}$  actual incident solar radiation intensity  $\eta$  solar cell efficiency difference initially assumed final calculated cell efficiency based measured cell temperature ',

'Thermal performance smart window predicted different simulated parameters namely direct solar radiation intensity ambient temperature water inlet temperature water flow rate Fig shows sample temperature distribution window components plane passing horizontal window segment based simulation physical conditions listed Table Simulation data collected successive simulations effect increasing direct solar radiation solar cells water temperatures shown Fig Three different simulations performed assuming direct solar radiation intensities  $W/m^2$  incident window front pane set ambient temperature water inlet temperature water flow rate respectively  $K$   $K$   $kg/s$  Water temperature found increase  $C$  passed tube carrying solar cells left right bottom units  $W/m^2$  direct incident solar radiation ',

'Shading detrimental factor performance domestic system impact shading performance varies depending electrical series parallel arrangement cells within module modules within installed array Whilst many approaches shading analysis proposed computational efficiency reported despite high importance incorporating shading algorithms overall energy yield model lack consideration non linear impacts shading smaller systems example means shading losses significantly underestimated especially supposedly small obstacles antennas chimneys example system shown Fig illustrates case installer may attested shade loss factor close unity UK microgeneration guidelines Microgeneration Certification Scheme i.e negligible performance system severely compromised due non linear cell mismatch effects effective shading sub model therefore needs give feedback inform decisions array layout proximity obstructions must rely high power computing ',

'Historically interest accurate measurement DNI started decades ago Early studies e.g Linke Linke Ulmitz identified difficulty separating measurement DNI diffuse irradiance immediate vicinity sun hereafter referred circumsolar irradiance Pastiels conducted detailed study geometry pyrhemimeters geometry interacted circumsolar radiance using simplified representations latter Various communications presented WMO Task Group meeting held Belgium WMO improve accuracy pyrhemimetric measurements including estimates circumsolar enhancement Ångström Ångström Rohde later contributed topic followed years later Major whole is issue instrument geometry vs circumsolar irradiance complex confusing time different makes models instruments differing geometries considerably simplified WMO issued guidelines recommended geometry pyrhemimeters led relatively standard geometry used recent instruments experimental issues related measurement DNI discussed Section ',

'Progressive photon mapping first proposed Hachisuka et al iterative extension standard static photon mapping approach implemented Radiance extension combines multiple smaller photon maps approximate much larger one may fit memory using traditional approach iteration process mitigates noise inherent Monte Carlo raytracing combining successive results averaging time density estimate bandwidth Bandwidth describes support area influence filter used weight photons retrieved photon map nearest neighbour lookup surface Jensen resulting irradiance proportional photon density bandwidth defined distance radius furthest photon found paper generalise term describe either radius number nearest neighbours density estimate depending implementation radius number nearest photons gradually reduced mitigate bias Hachisuka points accumulated density estimates converge unbiased solution limit ',

'wind speed cloud height Markov chains produced accounting seasonal variations Markov chain

ain used variable representing four seasons capturing variability different times year to talling four chains okta number Markov chains also consider effect season inclusion impacts pressure diurnal variation Eight okta Markov chains produced split average pressure season four additional morning okta Markov chains produced capture diurnal variation okta transitions am season intent capture variation transition probability occurs result weather changes due presence solar energy am considered cut off typical sunrise summer applied study locations h represents okta transitions considered appropriate duration slight propensity shift towards increased okta represented Fig demonstrates diurnal transition differences Fig visually demonstrates mean okta Markov chain entire year whilst effect season seen Fig ',

'reverse current analysis scenarios shading short circuits tested two systems one system using standard silicon modules another system using high efficiency modules standard silicon system power kWp considered system composed strings modules per string approximate system Voc VDC high efficiency system power kWp considered system composed strings modules per string approximate system Voc VDC Fig shows reverse current present one string different numbers modules string shaded Fig b shows reverse current present one string different numbers modules string short circuited figures continuous lines standard silicon system dashed lines high efficiency system ',

'addition prediction solar cell temperature important electrical characterisation CPV modules Rodrigo et al reviewed various methods calculation cell temperature High Concentrator PV HCPV modules methods categorised based heat sink temperature electrical parameters atmospheric parameters first two categories based direct measurements CPV modules indoor outdoor experimental setups presented highest degree accuracy Root Mean Square Error RMSE K methods reviewed Rodrigo et al calculate cell temperature open circuit conditions Methods predict cell temperature maximum power point MPP operation offer realistic approach since include electrical energy generation solar cells i.e. real operating conditions Yandt et al described method predicting cell temperature MPP based electrical parameters Fernández et al b based heat sink temperature absolute RMSE K Fernández et al a also proposed an artificial neural network model estimate cell temperature based atmospheric parameters open circuit voltage model based electrical parameters Fernandez et al a offering good accuracy RMSE K K respectively Rodrigo et al main disadvantage aforementioned methods experimental setup required obtain parameters used cell temperature calculation ',

'Although basic mechanisms AD process reasonably well understood proved simple apply existing theories interpretation experimental data needed combination AD theory electronic structure realistic systems including surface defects adsorbed species electronic structure calculations still complex time consuming many cases especially insulating surfaces attempts model MIES spectra use simple intuitive models Refs assumed main transition mechanism Auger de excitation MIES spectra simulated surface density states DOS projected surface oxygen ions uppermost surface layer using Hartree Fock method crystal code density functional theory DFT method cetep code effect overlap surface s wavefunctions taken account approximately applying additional z dependent exponential factor surface DOS workers estimated AD transition probability using DOS projected projectile s atomic orbital However a ble use state of the art methods surface electronic structure Yet success simplified treatments especially MIES features relative energies different peaks suggests real spectra indeed related projection surface DOS projectile orbital ',

'final contribution force van der Waals interaction includes following contributions macroscopic Si tip conical shape sphere radius R end semi infinite substrate ii dispersion forces atoms sample treated atomistically iii interaction macroscopic part tip sample atoms first contribution calculated analytically fact macroscopic contribution van der Waals force three systems described depends tip surface separation macroscopic sphere radius cone angle Hamaker constant system quantities identical system look van der Waals force acts background attractive force independent microscopic properties system Hamaker constant needed calculation macroscopic van der Waals force estimated eV ',

'present work use mortar finite element method coupling nonconforming discretized sub domains framework nonlinear elasticity mortar method shown preserve optimal convergence rates see Laursen details variationally consistent show method applied isogeometric analysis little effort framework NURBS based shape functions implemented Furthermore specific coordinate augmentation technique allows design energy momentum scheme constrained mechanical system consideration excellent performance redesigned mortar method well energy momentum scheme illustrated representative numerical examples In present work use mortar finite element method coupling nonconforming discretized sub domains framework nonlinear elasticity mortar method shown preserve optimal convergence rates see Laursen details variationally consistent show method applied isogeometric analysis little effort framework NURBS based shape functions implemented Furthermore specific coordinate augmentation technique allows design energy momentum scheme constrained mechanical system consideration excellent performance redesigned mortar method well energy momentum scheme illustrated representative numerical examples ',

'work numerical strategy designing optimal maintenance scheduling structure accounting explicitly effects uncertainty suggested contribution regarded extension methods developed presents several novel aspects similar approaches proposed literature Firstly initiation propagation fatigue crack modeled efficiently means cohesive zone elements application class elements allows modeling crack initiation propagation within unified framework noted

conesive zone elements already used uncertainty quantification crack propagation phenomenon However application within context maintenance scheduling constitutes novelty second innovative aspect contribution refers assessment reliability sensitivity respect variables define maintenance scheduling estimation sensitivity required order determine optimal maintenance schedule within proposed framework quite demanding model characterizing repair cracked structure leads discontinuous performance function associated failure probability new approach modeling function proposed herein continuous discontinuous parts respectively function considered separately estimate accurately gradients failure events ',

'Finite Element Tearing Interconnecting FETI methods powerful approach designing solvers large scale problems computational mechanics numerical simulation problem subdivided number independent sub problems coupled appropriate ways NURBS Non Uniform Rational B spline based isogeometric analysis IGA applied complex geometries requires represent computational domain collection several NURBS geometries Since natural decomposition computational domain several subdomains NURBS based IGA particularly well suited using FETI methods This paper proposes new Isogeometric Tearing Interconnecting IETI method combines advanced solver design FETI exact geometry representation IGA describe IETI framework two classes simple model problems Poisson linearized elasticity discuss coupling subdomains along interfaces matching interfaces interfaces T joints i.e hanging nodes Special attention paid construction suitable preconditioner iterative linear solver used interface problem report several computational experiments demonstrate performance proposed IETI method ',

'best authors knowledge far papers address performance linear algebra solvers Ref authors study performance direct solvers clearly suitable large problems specially three dimensions Ref tearing interconnecting approach finite element methods used context isogeometric analysis numerical tests absence theoretical study suggest almost optimal logarithmic factor convergence rates proposed isogeometric tearing interconnecting method paper provides rigorous theoretical study supported extensive numerical examples Beirao et al authors discuss overlapping Schwarz methods authors also proposed BDDC preconditioners isogeometric analysis ',

'attempt quite comprehensive answer question made hereafter within following structure remaining paper first introduce mathematical systems biology bone starting work Pivonka et al extending mechanoregulatory feedback control Section introduce continuum micromechanics representation adopted Hellmich et al order scale elasticity strains level extravascular bone matrix cortical bone In paper restrict cortical bone due major importance providing sufficient load carrying capacity However extension coupled approach proposed trabecular bone straightforward merely requires recalibration underlying parameters vice versa Section micromechanics formulation fed composition quantities derived systems biology approach turn provided mechanical stimuli gained micromechanics model apply coupled approach biochemical mechanical conditions typical postmenopausal osteoporosis Section microgravity exposure Section discuss key sensitivity features Section emphasizing potentials limitations presented approach Section conclude paper Section ',

'choice interpolation functions support point coordinates gradient field crucial ensure stability accuracy formulation example nodal integration NS FEM unstable involving appearance spurious low energy modes need non physical penalty energy functions stabilize articles numerically verify stability convergence accuracy several W variants including new elements constructed based idea assumed continuous deformation gradients first order hexahedral elements found good results element types  $C D_N C C D_N I$  first defined support points second order tensor product interpolation deformation gradient Lagrange polynomials latter element type defined support points points coincident nodes additional points element interior Among tested first order tetrahedra nodally integrated tetrahedron additional bubble mode gradients found accurate turned even efficient respect computing time explicit analysis enlarged critical time step compensates slightly increased numerical cost per restoring force assembly Fig illustrates positions support points various CAG SFEM formulations ',

'Algorithms regarding distance fields go back level set equation level set method presented Osher Sethian described temporal propagation moving interfaces numerical methods solving Hamilton Jacobi equation performed finite difference scheme working rectangular grid two three dimensions Information normal vectors curvature obtained fast marching method provides efficient numerical scheme complexity  $n \log n$  compute support values grid reinterpolation propagation process i.e time interface passes certain grid point influenced neighboring grid points previously passed interface overview theory level set fast marching methods applications problems various areas given example shape offsetting computing distances photolithography development seismic travel times etc Distance fields special case level set equation absolute value advection velocity ',

'article consider extension equations poroelasticity modelling flow slightly compressible single phase fluid viscoelastic porous medium constitutive equations therefore allow presence viscoelastic relaxation effects porous media fluid Fully discrete numerical schemes derived based lagged non lagged backward Euler time stepping method applied mixed Galerkin finite element spatial discretization show lagged scheme unconditionally stable give optimal priori error bound Furthermore scheme practical useful sense easily implemented existing poroelasticity software coupling viscous stresses pressures elasticity flow equations lagged one time step required additional coding therefore takes form extra right hand side loads together updating subroutines viscoelastic internal variables solver assembly

engines remain intact idea lagging used nonlinearly viscoelastic diffusion problems course new Lagging numerical schemes discussed widely Lowrie ',

'Traditionally simulation incompressible fluid flow SPH method weakly compressible SPH formulation WCSPH approach pressure treated thermodynamic variable calculated using artificial equation of state sound speed set sufficiently high limit density variations within small fraction actual fluid density practice high sound speed places limitation maximum permissible time step size Courant Friedrichs Lewy CFL constraint particular weakness relates to noise pressure field since small perturbation local density yields large variation local pressure make WCSPH formulations ineffective accurate force pressure prediction although recent developments create uniform particle distributions improved review SPH method found review classical WCSPH formulation applied free surface flows found ',

'paper however prefers simpler framed cell employed Hadjiconstantinou Patera shear stress generated constraining velocity frame rather modifying shape box framed cell periodic simply calculate average stress whole box presence external buffer would produce spurious results need local stress core region complicates Oij term Eq methods calculate stress tensors or method planes volume average approach method derived Schweitz virial relation general must choose complicated computational cell i.e. Lees Edwards cell simplifying calculation momentum flux simple cell i.e. framed cell complicating calculation momentum flux new method propose need direct calculation flux avoids issue altogether use framed cell time avoided calculation IK equation ',

'Powder metallurgy versatile technology manufacturing components near net shape high product quality hardmetal WC Co cold compaction powder green body followed liquid phase sintering subsequent heating means binder metal Co heated melt order obtain sufficient mobility via capillary action i.e. via surface traction stemming from stored surface energy resulting flow causes gradual filling pore space brings macroscopic shrinkage particle compact completely dense state obtained least ideally model quantitatively simulate sintering process challenging task goal estimate final resulting quality i.e. terms porosity ii predict final net shape size sintered component ',

'mentioned previously weakly penalized system thought generalized formulation result PL penalty statically condensed PL formulations depending on choice projection operator equivalence methods weakly penalized regime allows us combine take advantage good characteristics method instance weakly penalized formulation combines simplified structure penalty method convergence characteristics PL formulation However due to stiffness linear system high values bulk modulus penalized formulations classic penalty weakly penalized exhibit deteriorated nonlinear convergence stands stark contrast PL method inf sup stable schemes exhibits fast convergence even high bulk modulus However observe choice nh provides equivalence discrete PL method poor nonlinear convergence observed though principle convergence similar Examining update formulae weakly penalized PL approaches see Appendix C observe deteriorated convergence stems from initial residual amplification amplification residual ',

'Energy conservation critical to ensure stability numerical method especially contact collision problems number conserving schemes developed ensure energy conservation schemes make use of penalty regulation normal contact constraint inherit conservation property continuum problems conservation schemes conveniently combined finite element method simulate frictionless frictional contact collision Hesch Betsch formulated node to segment contact method solved large deformation contact problems conserving scheme recently energy momentum conserving temporal discretization scheme developed adhesive contact problems without considering friction dissipation Even though conserving scheme improves numerical stability also inherits penalty method difficulty determine penalty parameters order to remove penalty sensitivity Chawla Laursen proposed energy momentum conserving algorithm makes use of Lagrange multipliers instead of penalty parameters ',

'procedure addresses issue parameterizations vary for different flow types However Edeling et al carried separate calibrations set boundary layer flows summarized information across calibrations computing Highest Posterior Density HPD intervals subsequently represent total solution uncertainty probability box p box p box represents parameter variability across flows epistemic uncertainty within calibration prediction new boundary layer flow made uncertainty bars generated uncertainty information resulting error estimate shown consistent measurement data approach helpful might extended modelling proximity across flows distance would relate flow characteristics order to borrow strength across calibrations instead of splitting calibrations merging outcomes afterwards challenging attractive venue future research ',

'article proposes method adopts different approach generation procedure outlined helps address problem generating high order meshes high Reynolds number flows method conceptually simple cheap implement requires dense linear boundary layer mesh based use isoparametric general transfinite interpolation high order coarse boundary layer prismatic mesh subdivided either prisms tetrahedra using mapping defines coarse high order prisms procedure also versatile permits meshes different distributions y generated ease furthermore validity meshes guaranteed initial mesh valid polynomial space chosen appropriately ',

'shall establish variational format space time domain  $S \subset \Omega \times I$  given spatial domain  $\Omega$  time domain  $I$  quite broad class problems involving first order time derivative particular coupled problem consolidation geomaterials falls within class Another interesting application problem dynamics rewritten first order form i.e. Hamiltonian description considerable interest note outset due to forward transport information time always possible consider set



finite time intervals whereby solution end interval act initial data next one end introduce partition  $t \rightarrow t + \Delta t$   $N$  considered time domain  $t$  time intervals  $N$  in  $t_n$   $t_n$  length  $\Delta t_n$   $t_n$   $t_n$   $T$  he abbreviated notation  $\Delta t$   $\Delta t_n$  used henceforth current time step associated Hence define space time slabs  $S_n$   $\text{def} \Omega$   $I_n$  space time domain given  $S$   $\text{def} \Omega$   $I$   $S$   $S_n$  ',

'Isogeometric analysis central idea isogeometric analysis use ansatz functions discretization partial differential equation hand used representation problem geometry Usually problem geometry  $\Omega$  represented computer aided design CAD means NURBS  $T$  splines concept originally invented finite element methods IGAFEM proved fruitful applications see also monograph Since CAD directly provides parametrization boundary  $\Omega$  makes boundary element method BEM attractive numerical scheme applicable i.e. provided fundamental solution differential operator explicitly known Isogeometric BEM IGABEM first considered D BEM D BEM Unlike standard BEM piecewise polynomials well studied literature of monographs references therein numerical analysis IGABEM essentially open refer numerical experiments quadrature analysis particular posteriori error estimation well studied standard BEM e.g. well recent overview article treated IGABEM far purpose present work shed first light posteriori error analysis IGABEM provides mathematical foundation corresponding adaptive algorithm ',

'One important outcomes comparative analysis fact tested cases use FM associated dramatic reduction computational time compared FE generally order seconds FM order hours FE Table reports timings simulations methods Free expansion fastest case FM reaches load free configuration simulations inside vessels diameter around mm take approximately s execution time FM deployment algorithm dedicated contact check calculations implications vessel wall stent structure Interestingly methods highest computational time i.e. curved vessels associated complex geometry i.e. patient specific case aortic dissection Another fact worth mentioning relation computational time diameter vessel methods computational time FM appeared directly related diameter vessel immediate relation found FE simulations outcome probably related simplified contact model used FM makes stent graft expansion terminate nodes come contact vessel wall contrary well known contact algorithm used FE analyses increases computational cost simulations ',

'recent years Discontinuous Galerkin DG method emerged thorough alternative locally solving conservation laws shallow water equations higher accuracy DG method involves finite element weak formulation to inherently conservation principles shape piecewise polynomial solution local discrete cell via local basis functions basis DG polynomial accuracy spanned set coefficients describing accuracy information locally evolved time conservation principles discrete level arbitrary order accuracy DG based shallow water model appeals providing higher quality solutions coarse meshes traditional finite volume counterpart comparatively expensive run imposes restrictive stability condition CFL number ',

'FR schemes similar nodal DG schemes arguably popular type unstructured high order method least field computational aerodynamics Like nodal DG schemes FR schemes utilise high order nodal polynomial basis approximate solution within element computational domain like nodal DG schemes FR schemes explicitly enforce inter element solution continuity However unlike nodal DG schemes FR methods based solely governing system differential form description FR approach D presented information see original paper Huynh ',

'immersed boundary method IBM proposed Peskin studying flow patterns around heart valves applied wide range problems including arterial blood flow modelling cochlea modelling red blood cells Poiseuille flow flows involving suspended particles comprehensive list applications found IBM mathematical formulation numerical scheme fluid structure interaction problems mentioned classical fluid structure interaction problem fluid structure considered separately coupled together via suitable jump conditions IBM however structure which usually immersed Newtonian fluid is viewed part surrounding fluid means single equation motion needs solved i.e. one phase formulation Additionally IBM allows immersed structure move freely underlying fluid mesh alleviating need remeshing required classical formulation ',

'consider shape optimisation two three dimensional solids combining multiresolution subdivision surfaces immersed finite elements widely discussed isogeometric analysis literature geometry representations used today computer aided design CAD finite element analysis FEA software inherently incompatible particularly limiting shape optimisation given CAD geometry model iteratively updated based results finite element computation inherent shortcomings present geometry analysis representations motivated proliferation various shape optimisation techniques prevalent approaches surrogate geometry model analysis mesh instead true CAD model optimised see also references therein Generally tedious impossible map optimised surrogate geometry model analysis mesh back original CAD model essential continuing design process later manufacturing purposes Moreover geometric design features usually defined respect CAD model easily enforced surrogate model Recently shape optimisation shells solids applications using isogeometric analysis explored directly optimising CAD geometry model ',

'Gas sorption storage separation carbon materials mainly based physisorption surfaces particularly depend electrostatic dispersion i.e. vdW interactions former tuned introducing charge variations material latter chemical substitution strength interaction determined surface characteristics adsorbent properties targeted adsorbate molecule including limited size shape adsorbate molecule along polarizability magnetic susceptibility permanent dipole moment quadrupole moment Li et al summarise adsorption related physical parameters many gas vapour adsorbates herein Table show interest H<sub>2</sub> N<sub>2</sub> CO CO<sub>2</sub> CH<sub>4</sub> NH<sub>3</sub> SO<sub>2</sub> H<sub>2</sub>S instance adsorbent high specific surface area good candidate adsorption molecule high polarizability pol

arity Adsorbents highly polarized surfaces good adsorbate molecules high dipole moment adsorbents high electric field gradient surfaces found ideal high quadrupole moment adsorbate molecules Normally binding adsorption strength carbon nanostructure relatively low H N intermediate CO CH CO relatively high H S NH H O Thus surface modifications doping functionalization improving pore structure specific surface area nanocarbons important enhance gas adsorption purpose graphene offers great scope tailor made carbonaceous adsorbents ', 'exquisite manipulation exact measurement properties individual nanomaterials compared notable progress preparation thoroughly addressed albeit prime importance sustained development new devices date several instruments designed goals namely scanning electron microscopes SEM atomic force microscopes AFM transmission electron microscopes TEM Compared first two setups direct access material internal structure atomic bonding information state of the art situ high resolution TEM technique allows one manipulate individual object nanoscale precision also get deep insights physical chemical microstructural statuses Combining capabilities conventional high resolution TEM AFM STM probes produces advanced dedicated TEM holders becoming powerful tools nanomaterials manipulation properties analysis holders commercialized instance Nanofactory Instruments AB Goteborg Sweden full usefulness advanced in situ TEM techniques apparent respect mechanical thermal property analysis individual nanostructures e.g elasticity plasticity strength data employing direct bent tensile tests probing electrical characteristics e.g field emission electrical transport tracing soldering doping etc ',

'dominated surface shadowing mechanisms aggregation vapor particles onto surface complex non local phenomenon literature many attempts analyze growth mechanism means pure geometrical considerations i.e assuming vapor particles arrive film surface along single angular direction Continuum approaches based fact geometrical features film i.e nanocolumns much larger typical size atom also explored instance Poxson et al developed analytic model takes account geometrical factors well surface diffusion model accurately predicted porosity deposition rate thin films using single input parameter related cross sectional area nanocolumns volume material thickness film Moreover Ref analytical semi empirical model presented quantitatively describe aggregation columnar structures means single parameter dubbed fan angle material dependent quantity experimentally obtained performing deposition normal incidence imprinted groove seeded substrate measuring increase column diameter film thickness model tested various conditions returned good results accurate prediction relation incident angle deposition flux tilt angle columns several materials ',

'MINERAL MINeral ERror AnaLysis new MATLAB based program provides mineral formula recalculations combined associated propagation analytical uncertainties Methods based work Giamarita Day However additional features added provide users greater flexibility data reporting Many programs exist recalculate wt data formula unit cations generalized programs used recalculate formula multiple minerals e.g CALCMIN Brandelik HYPER FORM De Bjerg et al programs mineral specific e.g AMPH CLASS Esawi PROBE AMPH Tindle Webb recalculation amphibole analyses ILMAT Lepage recalculation magnetite ilmenite PX NOM Sturm recalculation pyroxene analyses MINERAL provides rapid method recalculation multiple common minerals However strength lies fact first tool incorporate associated uncertainty propagation calculations performed concurrently standard recalculations additional time needed perform uncertainty propagation understanding underlying calculations strongly recommended MINERAL designed allow users little experience operating MATLAB and or performing mineral formula recalculations uncertainty propagation undertake ease ',

'section use terrain data processing example describe geodetic data transformation method Since Google Maps Earth server gives terrain data graphical display get terrain digital data sources fine resolution finer terrain data bases SRTM Shuttle Radar Topographical Mission USGS s DEM Digital Elevation Model data necessary Moreover since DWF used model fine scale meters m atmospheric flow needs fine resolution terrain data project use terrain elevation data set SRTM Farr et al arcsecond m resolution equator resolution data covers land area nearly global S N latitudes use processed version SRTM data set described Gamache missing data holes filled original data organized WGS World Geodetic System geodetic coordinate system data applied DWF model transformed local East North ENU coordinate see Fig Since DWF fine scale wind model entire model domain intended larger km Cartesian coordinate system good choice little distortion due curvature Earth s surface transformation WGS data ENU coordinate performed follows Fukushima Featherstone Claessens ',

'number model parameters change regionally seasonally particular inherent optical properties water constituents  $a_1 \lambda$   $a_Y \lambda$   $a_D \lambda$   $b_X \lambda$   $b_b X$   $b_b$  Mie apparent optical properties bottom Rib  $\lambda$   $B_i$  atmosphere database provided WASI derived in situ measurements lakes Southern Germany Gege Heege Pinnel site specific information available used first approximation ecosystems well variability within ecosystem large different ecosystem i.e ecosystem specific sets optical properties exist However region season specific information used whenever available Ideally optical properties measured test site close airplane satellite overpass however always possible valuable source information IOCCG webpage IOCCG b maintains list links publicly available data sets example IOCCG data bank NASA bio Optical Marine Algorithm Data set NOMAD SeaWiFS Bio Optical Archive Storage System SeaBASS ',

'Artificial Neural Networks ANN widely used science engineering problems attempt model ability biological nervous systems recognize patterns objects ANN basic architecture consists networks primitive functions capable receiving multiple weighted inputs evaluated terms success discriminating classes Ta Different types primitive functions network configur

ations result varying models Hastie et al Rojas training network connection weights adjusted separation inputs predefined classes incurs error Convergence proceeds reduction error iterations reaches decay threshold Kotsiantis Rojas use feed forward networks single hidden layer nodes called Multi Layer Perceptron MLP Venables Ripley select one two possible parameters size number nodes hidden layer ',

'Hitherto investigation fossil orientation used topmost surface fossil mass occurrences deposited directly sea floor Due fast development virtual methods e.g macro CT  $\mu$  CT nano CT etc became possible investigate interior orientation fossil mass occurrences three dimensional detail Although series paleontological studies deal D visualization fossil elements mass occurrence previously reconstructed three dimensionally investigating interior orientation study illustrates interdisciplinary approach virtual reconstruction analyses interpretation interior orientation ammonoid mass occurrence method established herein produces clear consistent results using planispirally coiled ammonoid shells fossils far would used caution depositional interpretations method applied kind fossil mass occurrence even abundant organic elements particles examine orientation depositional conditions conclude paleoenvironment particularly paleocurrents ',

'Apache Pig platform creating MapReduce workflows Hadoop workflows expressed directed acyclic graphs DAGs tasks exist conceptually higher level implementations series MapReduce jobs Pig Latin procedural language used building workflows providing syntax similar declarative SQL commonly used relational database systems addition standard SQL operations Pig extended user defined functions UDFs commonly written Java adopted Pig implementation correlator speed development time allow ad hoc workflow changes embrace Hadoop community's migration away MapReduce towards generalized DAG processing Mayer Specifically event future versions Hadoop optimized support paradigms MapReduce Pig scripts could take advantage advances without recoding whereas explicit Java MapReduce jobs would need rewritten ',

'threshold values removing large craters determined examining craters within study area referencing previous studies Molloy Stepinski trial error parameter values determined rest process automated However anticipate minimum manual editing may needed complicated terrains apply Mars minimize distortion resulted map projection global datasets choose equal area projection evaluating options suggested Steinwand et al conduct geodesic area calculation using software Tools Graphics Shapes [http://www.jennessent.com/arcgis/shapes\\_graphics.htm](http://www.jennessent.com/arcgis/shapes_graphics.htm) Although post formational modification valleys may minimum Williams Phillips may nonetheless modifications eolian fill mass wasting e.g Grant et al Thus volume estimates derived PBTH method represents lower bound Comparing estimates MOLA HRSC data reveals MOLA estimate HRSC value However MOLA global coverage whereas HRSC Therefore areas MOLA coverage estimate may scaled upward times algorithm tested DEMs various resolutions simulated DEM m HRSC m MOLA certainly applied higher resolution DEMs Mars become available threshold values need adjusted ',

'discussion summarizes state art related impacts interpretations communication latency RT simulators However research focused primarily effect data loss communication mitigate thermoelectric co simulation example time constant larger thermal simulation power system simulation Thus communication latency significantly affect accuracy co simulation co simulation performed using resources location without synthetically introduced delays means communication latency RT simulators ignored authors mentioned communication latency important factor distributed simulation effect simulation stability studied future work in depth research role communication latency mitigation measure geographically distributed RT simulations identified technical gap addressed paper ',

'Despite fact SRC HE reduces number FEs audio measurements extraction based SRC would still suitable real time applications previous SRC HE module replaced generalised cross correlation phase transform GCC PHAT introduced Section involve cumbersome point function estimations drawback basic GCC algorithm detect one source time known sensitive room reverberations however still effective moderate reverberant environments T's reasons first experiments speaker active given time carried often happens polite conversation two people Speech segments using voice activity detector VAD extracted processed using GCC PHAT step signal robust reverberations Thus measure vector obtained see Section rewritten  $z_a$   $\mathbf{m}$  component  $\mathbf{m}$  TDOA collected  $\mathbf{m}$  th microphone pair time step  $t$  Since TDOAs linear speaker position must input extended Kalman filter EKF get audio position estimation ',

'paper construct physical model continuous distribution relaxations based phenomenological theory relaxation processes long history physics literature recently summarized monograph references relevant publications found also see present work confined relaxation mechanisms result changes normal stresses specifically interested local mechanisms irreversible energy loss caused uniform compression expansion medium components remain unchanged rather losses caused friction different layers medium move different velocities detailed discussion issue see attempt made model effects shear viscosity heat conduction beyond conventional Navier Stokes approach since topic goes far beyond scope paper ',

'propagation unsteady disturbances ducts slowly varying geometry typical aeroengine successfully modelled using multiple scales approach first application multiple scales analysis is sound propagation ducts rectangular circular cross section without mean flow recent developments extended method cases uniform mean flow swirling flow ducts arbitrary cross section uniform mean flow strongly curved ducts multiple scales approach number distinct advantages full numerical methods ideally suited handle higher frequencies computational complexity marginally calculating eigenmodes inside straight parallel duct accuracy us

erulness multiple scales approach validated finite element methods realistic aeroengine configurations acoustic frequencies ',

'describe three ways solve reflection problem first way simple Section exploit consequences shifting semi infinite row one period right left effect regard semi infinite row two scatterers one another semi infinite row idea goes back series papers Millar s starting used several two dimensional grating problems similar approach used layered media Shenderov one dimensional context obtain quadratic equation R show select correct solution remark much recent interest related two dimensional waveguide problems see example shifting by one period idea employed leading quadratic equation certain operator ',

'Max linear programs used describe optimisation problems multiprocessor interactive systems instances variables used model required integer however method seems exist finding integer solutions max linear programs For generic class matrices show integer solutions two sided max linear systems programs found polynomial time general matrices adapt existing methods finding real solutions obtain algorithms finding integer solutions ',

'study sequences optimal walks growing length weighted digraphs equivalently sequences entries max algebraic matrix powers growing exponents known sequences eventually periodic digraphs strongly connected transient periodicity depends general size digraph magnitude weights paper show bounds indices periodicity unweighted digraphs bounds Wielandt Dulmage Mendelsohn Schwarz Kim Gregory Kirkland Pullman apply weights optimal walks one ends critical node ',

'research traces implementation information system form ERP modules covering tenant contract management Chinese service company Misalignments ERP system specification user needs led adoption informal processes within organisation processes facilitated within informal organisational structure based human interactions undertaken within formal organisation Rather attempt suppress emergence informal organisation company decided channel energies staff involved informal processes towards organisational goals company achieved harnessing capabilities term hybrid ERP system combining functionality traditional formal ERP installation capabilities Enterprise Social Software ESS However company recognised successful operation hybrid ERP system would require number changes organisational design areas reporting structures communication channels narrative provided interviews company personnel thematised around formal informal characteristics organisation defined literature leads definition characteristics hybrid organisation strategies enabling hybrid organisation facilitated hybrid ERP system directs formal informal behaviour towards organisational goals provides template future hybrid implementations ',

'Owing widespread availability extensively adopted tomography technique utilizes milling power focused ion beam FIB conjunction imaging capabilities high resolution FE SEM provide sequence D images effectively re combined D space However technique destructive studies microstructural evolution influenced inherent sample variability Non destructive X ray nano computed tomography CT provides platform exploring dynamic microstructural change absence possible complications compatible laboratory synchrotron radiation authors previously demonstrated technique preparation optimal sample geometries X ray nano CT FIB sample preparation route involve selective removal portions fuel cell electrode microstructure therefore may destructive working fuel cell non destructive X ray characterization technique allows repeated non destructive characterization selected sample facilitates study microstructural evolution processes response various environmental changes ',

'conclusion new approach grind free nanoprecursor route direct combinatorial solid state synthesis several difficult make hitherto unknown phase pure heterometallic Ruddlesden Popper type La Ni  $x$ Fe $x$ O materials described new approach used high throughput reactor robotic automation RAMSI rapidly synthesise range nanoparticle co precipitate precursors cloned libraries rate samples hour library could heat treated different temperature initial powder XRD screen used locate approximate phase boundary focussed second synthesis XRD characterisation selected larger heat treated powders performed reconfirm locations phase boundaries highest dopant level achieved La Ni FeO significantly greater Fe doping achieved anyone previously despite several notable efforts EXAFS data suggested Fe located onto Ni sites cases exist separate iron oxide phase ',

'C nuclear densities localised tetrahedral volume roughly covering c f positions bulges nuclear densities pointing toward i position C continuous nuclear densities forming straight line along direction found indicative oxide ion diffusion pathway along direction literature curved pathways along direction passing i site generally observed fluorite materials prevalence curve pathway opposed straight pathway explained repulsion cation anions curved pathway allowing cation anion maintain reasonable distance However straight pathway observed Y Ta O case present material suggests Ta cations might play similar role systems ',

'impedance spectroscopy quite common method investigate mixed conducting thin film electrodes oxygen tracer experiments often performed bulk samples Recently several IEDP measurements mixed conducting cathode materials published oxide films deposited insulating substrates However best authors knowledge study far reported experiments techniques applied films temperature contribution reports results study applying EIS IEDP one La Sr CoO  $\delta$  LSC thin film order get complementary results resistive contributions oxygen reduction kinetics films electrical measurements require oxygen ion conductor yttria stabilized zirconia YSZ used substrate LSC films two different grain sizes Quantitative material parameters deduced types experiments comparison data allowed testing appropriateness analysis models .

'Thin MIEC layers GDC STFO single crystalline YSZ substrates exposed H<sub>2</sub>O atmosphere thermally electrochemically driven tracer exchange experiments Rectangular noble metal thin film current collectors deposited top beneath MIEC layer used polarization lateral distribution tracer revealed several interesting features case thermal tracer exchange enhanced tracer fraction found top metallic current collector due ionically blocking nature edges current collector concentration O decreases finite step width correlated in plane diffusion oxygen ions ii Due low electronic conductivity STFO GDC MIEC area influenced applied bias restricted region close current collector width active region depends bias amounts  $\mu\text{m}$  STFO  $\mu\text{m}$  GDC cathodic bias mV iii enhanced tracer incorporation due cathodic bias also reduced incorporation due anodic bias could experimentally resolved active region ',

'Two different micro contact set ups used experiments asymmetrically heated measurement set up Fig a allows change contacted electrode within seconds thereby gain statistical information large number different microelectrodes one sample relatively short time also enables monitoring optical changes measurement real time However asymmetrical heating bottom side local cooling e.g convection radiation contacting tip acting heat sink known cause temperature gradients within sample temperature gradients responsible thermo voltages lead measurement artifacts electrochemical experiments Moreover set up temperature cycles hardly performed single microelectrodes require subsequent contacting de contacting different microelectrodes ',

'Room temperature powder X ray diffraction XRD performed PANalytical Empyrean diffractometer obtained XRD patterns analysed STOE Win XPOW software order determine phase purity crystal structure cell parameters samples Thermogravimetric analysis TGA performed using Netzsch STA C instrument equipped Proteus thermal analysis software TGA studies carried reducing conditions H<sub>2</sub> Ar room temperature C order determine weight change perovskite reduction microstructure samples surface analysed using JEOL JSM field emission scanning electron microscope FEG SEM total conductivity samples measured using conventional four terminal method Bar samples prepared calcination C h Gold wire contacts attached bars cured C h conductivity samples measured redox cycle C Low oxygen partial pressure achieved using continuous flow H<sub>2</sub> Ar ',

'bond failure thought micro crack nucleation specifically separation adjacent cells cellular structure along common face Initially micro cracks may dispersed model reflecting random distribution pore sizes low level interaction due force redistribution Interaction coalescence may follow population micro cracks increases situations illustrated Fig structure failed surface represented mathematical graph graph nodes represent failed faces graph edges exist failed faces common triple line cellular structure i.e two micro cracks formed continuous larger crack reference Fig failed face graph node pair neighbouring failed faces graph edge ',

'nanocomposite system consisting semiconducting matrix embedded ferromagnetic nanostructures fabricated ferromagnetic characteristics coercivity remanence magnetic anisotropy nanocomposite adjusted electrochemical parameters Furthermore spatial distribution metal structures within pores varied means magnetic interactions particles influenced case densely packed particles within pores dipolar coupling occurs results quasi magnetic chains offer much larger magnetic anisotropy non interacting particles modifying current density small Ni particles nm deposited packing density particles sufficiently close Ni tubes nanometer thickness covering pore walls presented nanocomposite interesting system magnetic applications magnetic sensor technology Silicon substrate renders composite good candidate integration existing process technology ',

'progression towards smaller lithographic nodes continues become necessary adopt thinner resist films mitigate problems pattern collapse address issue reduced etch resistance thin photoresist films semiconductor industry begun develop multilayer processes pattern first transferred intermediate organic hardmask higher etch selectivity final silicon pattern transfer paper demonstrate introduction multilayer process also benefit nanosphere lithography increasing achievable aspect ratios silicon nanopillars without need complex etch processes requiring specialised expensive equipment instead needing standard SF<sub>6</sub>/CF<sub>4</sub> inductively coupled plasma ICP mixed mode etch process room temperature intermediate layer material used polyimide finds widespread use encapsulation material IC production readily patterned oxygen plasma lower etch rate silicon SF<sub>6</sub> gas flexibility also used fabrication soft polymer pillars process show multilayer process slightly increases complexity sample preparation allows basic ICP etching achieve high aspect ratio structures smaller feature sizes previously reported without need complex etching equipment ',

'D finite element based FEM COMSOL capacitance analysis combined Monte Carlo single electron circuit simulations model device operations single electron detection D structural data Fig b nanoscale DQD pair multiple gate electrodes precisely input COMSOL FEM based electrostatics simulator Capacitances different device components extracted fed well tested single electron circuit simulator SETSPICE based orthodox theory single electron tunneling target d nm simulation results Fig c showed sweep voltage applied gate G VG single electron tunnelling turnstile two QDs generate shifts electrometer current IDS tens pA well within charge sensitivity DQD electrometer consistent order magnitude previous work single electron detection addition gate QD capacitive coupling appear sufficient control QD occupations single electron limit allowing future manipulation single electron spins qubit research ',

evaluated three spin on carbon nanomasks irrisistible Materials spin on carbon composit ions dissolved suitable solvent chloroform anisole concentration range g l report film th ickness measurements made IM HM IM HM films whilst IM HM used etching investigations comp are performance different compositions across tasks underway Films SoC prepared spin coat ing hydrogen terminated silicon substrates speed varying RPM s spin coating film baked mi n temperatures C order enable processing SoC rendered insoluble typical solvents resist s pin on hardmask enable processing elution behavior films IM HM IM HM thicknesses nm teste d function baking temperature Fig shows normalized film thickness two formulations SoC IM HM IM HM dipping monochlorobenzene MCB IPA solution Prior baking thickness IM HM nm thick ness IM HM nm temperatures C IM HM film rendered insoluble whilst temperature C required achieve IM HM Film thickness affect elution results ',

'summary developed technique site specific nanowire size reduction FIB thinning Transmis sion electron microscope images thinned tungsten composite nanowire width reduced nm show uniform shrinking along length wire high resolution images show obvious changes morpholog y thinning critical current density as deposited wire one thinned width nm A cm K respect ively suggesting insignificant modulation electrical properties thinning results suggest FIB milling potential approach controllable size reduction high resolution towards observ ation size quantum effects well construction D superconducting nanodevices ',

'suggestions electrons trapped bulk surfaces silica new models electron trapping centres started appear recently suggested Bersuker et al used molecular models electrons trapped Si O bonds a SiO leading weakening thus facilitating Si O bond dissociation calculations Camellone et al shown electrons spontaneously trap non defective continuum random network model a SiO Recent calculations also demonstrated two dominant neutral paramagnetic defec ts surfaces a SiO non bridging oxygen centre silicon dangling bond deep electron traps fo rm corresponding negatively charged defects However theoretical predictions yet confirmed experimentally emphasising challenges identifying defect centres ',

'Ever since identification paramagnetic E centre SiO unpaired electron localised sp hybr id orbital Si atom backbonded three oxygen atoms number attempts made explaining optical electronic properties SiO presence E centres irradiation hole injection induces trapping positive charge thin layers a SiO grown silicon surfaces thermal oxidation effect correla ted paramagnetic E centre signals led initial assignment neutral oxygen vacancy major hol e trap a SiO model originally proposed E centres  $\alpha$  quartz upon trapping hole one Si atom two Si atoms constituting vacancy remains neutral hosts localised unpaired electron count erpart becomes positively charged Although model initially accepted widely simplicity fai ls account number observations positive charge trapping without generation E centres form ation high density E centres without corresponding density positive charge absence correl ation decrease E centre density density positive charge upon post irradiation electron in jection SiO ',

'Ge wafers n p type cleaned ultra high vacuum mbar C C min evaporate native oxide achiev e oxide free surface Subsequently wafers exposed Al flux range times deposit ultrathin Al layers samples oxidized ambient temperatures MBE load lock produce Al O layers samples tr ansferred within min Oxford Instruments OpAL reactor thin films HfO deposited Al O using atomic layer deposition ALD HfO depositions used CpMe HfOMeMe precursor coupled O plasma oxidizing species ALD cycles used grow HfO thicknesses nm C electrical measurements circu lar gold contacts area cm deposited onto films form MOS gate electrodes Al deposited back Ge wafers provide ohmic contact preliminary measurements samples annealed forming gas FGA C min oxide leakage current measured using Keithley B voltage source Keithley B electrome ter HP A low frequency LF impedance analyzer small signal frequencies Hz MHz used perform high frequency capacitance voltage HF CV measurements ',

'demonstrated new approach manufacture self folding hydrogel scaffolds use readily avail able fast throughput methods process shows effective pattern transfer first embossing sac rificial layer using soluble mould fabrication process use sacrificial layer PAA imparts environmental sensitivity hydrogel film one surface subsequent swelling PAA inter penetra ting network IPN elevated pH causes swelling differential across film causing roll accomm odate difference surface area two surfaces surface functionalization patterning stages th us combined one photolithographic operation net result method producing environmentally t riggered self folding hydrogel scaffolds authors knowledge novel use sacrificial layer em bossing patterned hydrogel films triggered consecutively allowing successive rolling unro lling depending aqueous pH choice PEGDMA hydrogel provides versatile platform creating va riety hydrogel scaffolds non fouling nontoxic permeable proteins Furthermore PEGDMA modif ied produce biodegradable cell adhesive hydrogels variety biomedical applications ',

'number experiments conducted reduced selecting four important parameters variation Tabl e remaining parameters kept constant O flow rate QO keep constant sccm SF flow rate QSF v aried sccm pressure etch chamber controlled keep gas density stable Since pressure pronou nced effect etch characteristics pressure p varied mTorr noted system run automatic press ure control mode continuously adjusts throttle valve keep constant pressure etch coil pow er PC fixed W bias power PB varied W Finally substrate chuck temperature controlled C des ign resulted full factorial screening four parameters three center points used check quad ratic curvature quadratic term parameter needed generate valid model total number experim ents setup processed min experiments design carried random order ',

'used  $\mu\text{m}$  ultra nanocrystalline diamond UNCD grown chemical vapour deposition CVD  $\mu\text{m}$  sili con carrier wafer Advanced Diamond Technologies Ltd Detailed information material stamp f

abrication found earlier paper UNCD wafer scribed cm samples subjected RCA cleaning SC allowed ultrasonic solvent cleaning Nanofeature stamps created samples using conventional electron beam lithography EBL negative tone electron sensitive resist hydrogen silsesquioxane HSQ Al discharge layer required resist prevent e beam deflection due charge build up surface Several stamps produced process pattern written varied design consisted arrays circular pillars EBL HSQ development HSQ used etch mask RIE mixture oxygen argon gas etched diamond nanopillars typically nm high Fig displays scanning electron micrograph typical stamp features ',

'Copper electro chemical deposition ECD silicon via TSV key challenge D integration paper presents numerical modeling TSV filling concerning influence accelerator suppressor diffusion adsorption model used simulation effects additives incorporated model boundary conditions derived set experimental Tafel curves different concentrations additives provided quick accurate way copper ECD process prediction without complicated surface kinetic parameters fitting level set method LSM employed track copper electrolyte interface simulation results good agreement experiments given feature size current density superfilling could predicted provided guideline ECD process optimization ',

'restrict pollen tube growth single focal plane important subject enable accurate growth analysis microscopic observation conventional method assay pollen tube growth pollen tubes grow disorderly manner solid medium rendering impossible observe growth detail present new method assay pollen tube growth using poly dimethylsiloxane microchannel device isolate individual pollen tubes growth pollen tube confined microchannel focal plane allowing accurate microscopic observations methodology potential analyses pollen tube growth microfluidic environments response chemical products signaling molecules paves way various experiments plant reproduction ',

'order study mechanical behavior metal films compliant polymer substrates fragmentation testing often employed fragmentation testing film substrate couple strained uni axial tension observed light microscopy LM scanning electron microscopy SEM Brittle metals ceramic films fracture forming thickness cracks channel cracks low strain perpendicular straining direction hand ductile metal films first deform locally form necks low strains Fig a increased strain thickness cracks TTC evolve Fig b Fragmentation testing best performed in situ LM SEM strain first crack forms observed initial fracture strain film also known crack onset strain used determine interfacial fracture shear stress knowledge crack spacing saturation  $\lambda$  film thickness  $h$  fracture stress of  $E_{film}$   $\epsilon_f$  fracture strain using shear lag model In situ fragmentation testing LM SEM allows crack spacing evolution observed function applied strain Fig c tensile straining conditions brittle film initially fracture low strains strain continue form cracks saturation crack spacing reached saturation spacing reached cracks longer form existing crack fragments film could delaminate via buckling ',

'PDMS Polydimethylsiloxane become far popular material academic microfluidics community inexpensive easy fabricate replication molds made using rapid prototyping techniques flexible optically transparent biocompatible fabrication require high capital investment cleanroom conditions Various techniques adapted fabricate microfluidic structures PDMS including wet dry etching photolithographic patterning photosensitive PDMS laser ablation soft lithography techniques introduced Whitesides et al enabled widespread use PDMS opened era PDMS based microfluidics late s Replica molding casting prepolymer master generating replica master PDMS become standard fabrication technique available almost every research laboratory Detailed overviews soft lithography techniques applications found reviews McDonald et al Sia et al Nowadays many tools dedicated purpose available purchased complete set e.g SoftLithoBox provided Elveflow USA Moreover companies FlowJEM Canada Microfluidic Innovations USA Scientific Device Laboratory USA provide rapid prototyping service PDMS based LOC devices ',

'Unlike conventional materials used nerve tissue engineering PAs directly injected vivo models spontaneously self assemble nanofibers aqueous solutions Furthermore PAs function biomimetic materials exemplified collagen mimetic PAs Conventional materials often rely electrospinning manufacturing method achieve fiber like structures suitable use nerve regeneration self assembly nature PAs allows circumvent costly manufacturing methods However contrast conventional manufacturing methods like electrospinning quality batch to batch variability tightly controlled merely relying self assembly method large scale commercial production still experimental concept Perhaps next step would carefully compare contrast robustness self assembled PAs electrospun nanofibers Given constituent elements PAs external factors like pH affect structural assembly parameters must finely tuned optimized order PA nanofibers used full fledged commercialized medical product ',

'addressed question whether carbohydrate coupling increased antigen uptake DCs via C type lectin receptor targeting Therefore antigens labeled pHrodo Red dye Invitrogen dye specifically fluoresces pH decreases neutral acidic provided endosomes lysosomes cells vitro characterization cellular uptake neoglycocomplexes using bone marrow derived dendritic cells BMDCs demonstrated superior ingestion mannan conjugates MN Ova MN Pap Supplementary Fig S A D F confirmed vivo intradermal needle injection labeled antigen ear pinnae mice Antigen uptake transport ear dLNs measured h FACS analysis DCs cervical LNs identified according high expression MHC class II Fig A additionally characterized CD  $\alpha$  CD b CD c expression uptake pHrodo labeled antigen Fig B D F results showed significantly elevated numbers pHrodo MHCIIhigh DCs mannan conjugates MN Ova MN Pap lesser degree MD Pap comparison unmodified antigens Fig C carbohydrates targeted antigen preferentially CD  $\alpha$  DCs indicated

increase CD  $\alpha$  phrodo DCs compared unmodified antigens Fig E F Nevertheless whether antigens taken situ dermal DCs LN resident APCs via afferent lymphatics could fully elucidated Histology revealed antigen loaded cells dLNs already present min intradermal injection Supplementary Fig S G suggesting mechanisms ',

'mesoporous silica particles prepared surfactant self assembly method described previously Briefly homogeneous solution soluble silica precursor tetraethylorthosilicate TEOS Sigma Aldrich Corp St Louis MO hydrochloric acid mixed ethanol water surfactant cetyltrimethylammonium bromide CTAB Sigma Aldrich Corp St Louis MO initial concentration much less critical micelle concentration added lower surface tension liquid mixture act mesoporous structure directing template Aerosol solutions soluble silica plus surfactant generated nitrogen carrier atomizing gas using commercially available atomizer Model A TSI Inc St Paul MN aerosol droplets solidified tube furnace C dry dried durapore membrane filter kept C used collect particles final step surfactant removed C h via calcination surface mesoporous silica core studies chemically modified wt wt aminopropyltriethoxysilane APTES Sigma Aldrich Corp St Louis MO conducted identically previously described create positive surface charge increase loading efficiency negatively charged cargo Liu colleagues report colloidal stability protocells lipid bilayers excess amount liposomes  $\mu$ g liposomes per mg silica used ',

'Mice bearing orthotopic model treated starting day NB cell implant mice pseudo metastatic model received first treatment h NB cell injection therapeutic schedules designed test effects targeted formulations established pseudo metastatic preclinical models human NB described Animals treated i v week weeks untargeted SL DXR peptide targeted SL DXR mg kg S scrambled peptide functionalized liposomes used control every experiment group control mice received HEPES buffered saline Survival times used main criterion determining treatment efficacy orthotopic model time dependent anti tumor activity also evaluated bioluminescence imaging BLI X ray analyses purpose GI LI N cell line infected retrovirus expressing firefly luciferase gene previously reported luciferase activity retrovirally transduced cells visualized vivo BLI IVIS Caliper Life Sciences Hopkinton min incubation  $\mu$ g mL d luciferin Caliper Life Sciences described X ray analysis superimposed luminescence better visualization tumors ',

'limitation pharycyte approach one time nature intervention ACT T cells loaded cargo adjuvant drug prior transfer duration stimulation inherently limited expansion cell population vivo since cell bound particles diluted cell division hypothesized strategy target supporting drugs T cells nanoparticle drug carriers directly vivo would enable transferred lymphocytes repeatedly stimulated supporting adjuvant drugs thereby provide continuous supporting signals prolonged durations might necessary elimination large tumor burdens removing T cells supporting drugs could achieved repeated administration targeted particles allowing adoptively transferred T cells restimulated multiple times directly vivo use internalizing targeting ligands would minimize likelihood immune responses nanoparticle carrier knowledge two prior studies attempted target nanoparticles T cells vivo studies particles targeted T cells via peptide MHC ligands bind specific T cell receptors However peptide MHC functionalized nanoparticles recently shown deliver anergizing tolerizing signal T cells ideal treating graft rejection autoimmunity runs counter goals cancer immunotherapy ',

' $\alpha$   $\omega$  aminohexylcarbamate derivative cyanocobalamin prepared using method described previously Briefly solid CDI mg mmol added cyanocobalamin g mmol previously dissolved anhydrous dimethyl sulfoxide mixture stirred h C followed addition dry hexanediamine mg mmol stirring mixture room temperature h mixture poured ethyl acetate ml left stand Following centrifugation decanting supernatant residue sonicated min acetone ml resulting precipitate filtered solid washed acetone crude product purified silica column chromatography v v propanol v v n butanol v v ammonia v v water followed lyophilisation ',

'Immunopotentiators activate innate immunity directly example cytokines pattern recognition receptors PRRs bacterial components Toll like receptors TLRs family PRRs important link innate adaptive immunity studies shown TLR ligands adjuvant activity enhance antigen specific antibody cell mediated immune responses especially combined delivery systems promote uptake delivery antigen presenting cells clinical studies TLR generally stimulated synthetic oligodeoxynucleotides containing one unmethylated CpG dinucleotides humans CpG used adjuvant infectious disease vaccination development cancer therapy mouse model CpG also shown induce helper Th immune responses characterized production IFN  $\gamma$  generation IgG a Moreover previous study demonstrated different liposomes CpG ODN significantly increased Th biased cytokines augmented cell mediated immune response ',

'Two methods formulating anionic nanocomplexes evaluated nanocomplexes prepared water range molar charge ratios L peptide P molar charge ratio maintained constant Method L P DNA first added anionic liposome LA LAP LAP incubated min room temperature peptide added rapid mixing incubated room temperature min Method P L peptide added DNA incubated min room temperature liposome added rapid mixing incubated room temperature min Irrespective method order mixing molar charge ratios study refer L P D Cationic formulations LPD LCPRGPD prepared order L P described previously first peptide added liposome DOTMA DOPE LCPRG followed addition DNA rapid mixing incubated min room temperature allow complex formation nanocomplexes prepared termed LPDliposome DOTMA DOPE LADP PDLA liposome LA PDLAP liposome LAP PDLAP liposome LAP PDLAPRG liposome LAPRG LCPRGPD liposome LCPRG ',

'UltrasoundUS initiate release drugs liposomes via event called inertial cavitation where



replay rarefactional phase ultrasound wave causes expansion gas bubble followed violent collapse due inertia surrounding media collapse creates shock waves disrupt stability co localised liposomal drug carriers date studies concentrated use low frequency high intensity US generate gas bubbles situ recently parameters used achieve variable level triggered drug release following intratumoral injection liposomes However concerns persist damage non target tissue US exposure parameters may cause whether ultimately widely clinically applicable alternative strategy utilise high frequency US pulses pressures diagnostic range presence pre existing gas bubbles provides inertial cavitation stimulus drug release using safe clinically achievable US exposure conditions approved US contrast agents Indeed context improving delivery therapeutics oncolytic viruses approach already shown great promise advantage approach US induced cavitation events produce distinct acoustic emissions recorded characterised providing non invasive feedback feature proven useful ablative US applications ',

'widely used ion source FIB instruments gallium Ga liquid metal ion source LMIS Gallium attractive ion source low melting temperature C standard atmospheric pressure low volatility However materials show sensitivity Ga ion beam sensitivity manifested changes structure chemical composition starting material upon exposure Ga ion beam Group III V compound semiconductors one class materials show sensitivity Cryo FIB milling recently reported suppress reactions Ga ion beam III V materials suggested advantage cryo FIB milling room temperature milling Group III V materials appealing given variety present potential future applications materials e.g. electronic photonic devices given favorable electron transport direct band gap properties associated several III V semiconductor systems ',

'crack band approach producing mesh independent load displacement curves fracture plain concrete based idea crack opening transformed inelastic strain distributing element length dependent zone approach produce mesh independent load displacement curves inelastic strain profiles finite element analysis mesh size dependent requirement important difference nonlocal model designed produce mesh size independent load displacement curves strain profiles CDPM crack band approach applied tensile part damage algorithm replacing stress inelastic strain law shown Fig b stress inelastic displacement law form  $\sigma = \sigma_{ftexp} \epsilon^{inhwft} \epsilon_{inhwft}$  crack opening threshold used control slope softening curve h width crack band present study equal maximum dimension element along principal direction strain tensor corresponding maximum tensile principal strain onset damage compressive part stress inelastic strain law used determine compressive damage parameter since reported columns subjected eccentric compression inelastic strain profiles compression exhibit mesh dependence would satisfy assumptions crack band approach applying crack band approach tensile part already successfully used Grassl et al ',

'HOMO LUMO energy band gaps ylides pyrene adducts propose DC second pyridinium ylides ylidyrene adducts HOMOylide LUMOylide pyrene controlled since energy band gap smaller HOMOylide pyrene LUMOylide Regioselectivity second cycloaddition predicted using atomic orbital coefficients corresponding HOMOylide LUMOylide pyrene According Fukui reactions favorable direction maximal HOMO LUMO overlapping larger coefficients reactive sites favorable interactions corresponding ylides ylidyrene adducts form favorable regioisomer conformation given Fig Second ylide addition ylidyrene structure therefore anticipated proceed via ylideC C ylidyrene C ylideC ylidyrene C interactions produce regioisomer conformations Considering theoretical calculations performed pyrrolidine attached pyrene structure also expected formation type regioisomers favorable SWNTs DC pyridinium ylides Fig ',

'Gamma titanium aluminides family low density high performance alloys potential replace current Ni base superalloys used production aero engine components Investment casting one economical methods produce titanium titanium aluminide alloy products increasing components integrity mechanical properties whilst reducing material waste machining cost Titanium aluminides difficult process mainly due low fluidity TiAl alloy around melting temperature Due high affinity elements oxygen nitrogen etc titanium alloys easily interact mould materials investment casting process resulting interaction hardened layer generated metal surface hardened layer contains large amount dissolved oxygen brittle susceptible crack generation propagation ',

'Half metallic ferromagnets HMF attracted enormous interest due applications spintronic devices Dilute magnetic semiconductors DMSs considered best materials show half metallicity materials two components one semiconducting material diamagnetic properties magnetic dopant transition metal unpaired electrons major advantage materials utilization electron spin information carrier since advanced functionalities spintronic devices viable use spin degree freedom along charge electrons major issue regarding applicability materials enhance Curie temperature room temperature s research interest shifted towards large band gap materials lot work reported DMSs different II VI III V semiconductors host material ZnS CdS GaN ZnO ZnSe ZnTe TiO SnO ',

'study commercial Al Si alloy inoculated different level Nb B addition assess grain refining potency Nb B inoculation concluded in situ formed Nb based intermetallics compounds potent heterogeneous nucleation substrates high potency refinement Al Si cast alloys primary  $\alpha$  Al dendritic grain size varies addition level Nb B Moreover significant grain refinement wide range cooling rates obtained via enhanced heterogeneous nucleation making grain size material less sensitive cooling rate Nb B inoculants characterised fading still acceptable h contact time Moreover alloys refined means Nb B inoculants recycled obtaining fine grain structure small addition addition inoculants first initial addition Concluding

No B inoculation promising candidate refinement cast Al alloy could lead wider employment automotive industry resultant intrinsic advantages lighter structural component environmental point view ',

'observed conductivity A FeMoO<sub>4</sub> δ Ca Sr Ba linked potential double exchange mechanism conduction Fe O Mo O Fe Double exchange mechanisms proposed Zener posit electron transfer ions different oxidation states may facilitated electron alter spin state Replacement Mo Fe mechanism would expected result reduction conductivity reduction available percolation pathways unless delocalisation Fe electrons Fe O Fe exchange could also occur Double exchange mechanisms observed previously mixed valent iron iron oxides iron known exist mixed valent state Ca xSrxFeMoO<sub>4</sub> δ provides plausible explanation observed metallic conductivity B and structure calculations Mossbauer spectroscopy could utilised elucidate conduction mechanism compounds however outside scope enquiry ',

'According ellipsometric spectra optical constants physical parameters extracted appropriate fitting model order estimate optical constants dielectric functions Ni doped TiO<sub>2</sub> films three phase layered system air film substrate utilized study ellipsometric spectra TiO<sub>2</sub> belongs wide band gap semiconductors Considering contribution M type critical point lowest three dimensions dielectric function calculated Adachi's model  $\epsilon = \epsilon_{\infty} + \frac{A}{E^2 - E_{EOBG}^2}$  incident photon energy  $E$  high frequency dielectric constant  $\epsilon_{\infty}$  E<sub>EOBG</sub> optical gap energy A Γ strength broadening parameters EOBG transition respectively example experimental SE film TN incident angle dot scatter shown Fig Fabry Péro<sup>t</sup> interference oscillations due multiple reflections within film found photon energy eV nm nm indicates films transparent region Note good agreement experimental calculated spectra attained whole measured photon energy range fitting thickness film TN nm near value obtained SEM see Fig b ',

'Fig shows relationship testing time friction coefficients various samples dry conditions exist running steady wear period wear process uncoated AZ anodizing coating without Al<sub>2</sub>O<sub>3</sub> nanoparticles steady wear period wear process composite anodizing coating Al<sub>2</sub>O<sub>3</sub> nanoparticles time addition nano particles electrolyte led reduction friction coefficient friction coefficient composite coating relatively lower stable reported literature anodizing coatings may caused rolling effect made Al<sub>2</sub>O<sub>3</sub> nanoparticles surface oxide coating Spherical nanoparticles change sliding rolling reduce friction making friction coefficient becomes stable friction coefficient anodizing coating without Al<sub>2</sub>O<sub>3</sub> nanoparticles large fluctuation maybe damage coating contrast uncoated AZ magnesium alloy anodizing coatings show slightly lower friction coefficient attributed higher load bearing capacity high hardness ',

'Functionally Graded Materials FGMs described detail Suresh Mortensen type heterogeneous composite materials exhibiting gradual variation volume fraction constituents one surface material resulting properties vary continuously across material idea Functionally Graded Material new one fact many natural materials exhibit property Study bone shell balsa wood bamboo shows graded greatest strength outside areas greatest protection required However Japan idea Functionally Graded Material actively researched order gain advances heat resistant materials use aerospace nuclear fission reactors ',

'Recently together structural efficiency passenger safety also important issue application material transportation industries Hence crashworthiness parameters introducing predict capability structure prevent massive damage protect passenger event crash Crashworthiness parameters various thin walled tubes made metal fibre resin composites different geometries studied critical difference tubular composites failure modes compared metallic brittle collapse addition composites tubular failure modes involved micro cracking development delamination fibre breakage etc instead plastic deformation Implementation composite materials field crashworthiness attributed Hull's last century studied extensively crushing behaviour fibre reinforced composite material found composite materials absorbed high energy face fracture surface energy mechanism rather plastic deformation observed metals observation inspired others investigation crashworthiness characteristics composite materials Studies examined axial crushing behaviour fibre reinforced tubes fibreglass tubes PVC tubes carbon fibre reinforced plastic CFRP tubes ',

'address vertical displacement estimation conventional pile groups subjected mechanical loads various numerical analytical methods proposed methods include finite element method e.g boundary element method e.g finite difference method e.g interaction factor method e.g equivalent pier raft methods e.g settlement ratio method e.g finite element method providing rigorous exhaustive representation pile group related problem generally computationally expensive considered mainly research tool rather design tool Conversely versatility simplified approximate methods interaction factor approach allows capturing e.g vertical displacements general pile group analysis displacement interaction two identical piles use elastic principle superposition effects makes attractive design tools allow use expedient parametric studies various design conditions ',

'known fragmentation processes polyatomic molecules induced intense ultrafast laser field sometimes exhibit sensitive dependence instantaneous phase characteristics laser field Depending change sign chirped laser pulses fragmentation could either enhanced suppressed Controlling outcome laser induced molecular fragmentation chirped femtosecond laser pulses brought forth number experimental theoretical effects recent years However efforts continuing specific fragment channel enhancement difficult since also function molecular system study report observation coherently enhanced fragmentation pathway n propyl benzene seems specific fragmentation channel available found n propyl benzene relative yield C<sub>2</sub>H extremely sensitive phase laser pulse compared possible channels fact almost order magnitude

enhancement yield CH negatively chirped pulses used effective positive chirp Moreover relative yield heavier fragment ions resulting interaction strong field molecule sensitive sign chirp within noise level ',

'vibrational spectra l cysteine recorded assigned solution solid state Spectral assignments made using empirical force fields Hartree Fock calculations based isolated molecule approximation systems exhibit strong intermolecular interactions approximation often leads poor agreement experiment theory striking example purine study solid state vibrational spectra isolated molecule periodic calculations gave almost quantitative agreement theory experiment latter whereas former gave modest agreement unable distinguish tautomers present case structure consists ions linked hydrogen bonds periodic calculations based complete primitive cell essential work includes solid state effects used molecular dynamics difficult extract assignments aim paper provide complete assignment vibrational spectra l cysteine orthorhombic monoclinic forms use combination computational experimental methods ',

'critical success NPD technique MOF complex adsorbs significant amount D boost observed signal technique therefore disadvantages studying binding interaction within MOFs low uptake Furthermore static crystallographic studies provide insights dynamics adsorbed gas molecules Thus challenging probe experimentally H binding interactions within porous host system low gas uptake due lack suitable characterisation techniques report herein application situ inelastic neutron scattering INS technique permit direct observation dynamics binding interactions adsorbed H molecules aluminium based porous MOF NOTT exhibiting moderate porosity narrow pore window low uptake H neutron spectroscopy study reveals adsorbed H molecules interact organic ligand within pore channels form weak interactions Al OH O moieties via type through spacing interaction Al O H Interestingly low H adsorption successfully characterised weak binding interactions first time found adsorbed H pore channel liquid type recoil motion K melting point direct result weak interaction MOF host ',

'optimised structure B LYP aug cc pVTZ level used perform calculations lowest electronic singlet excited states coupled cluster linear response LR coupled cluster hierarchy CCSD CC along perturbative corrected methods CIS CCSDR correlated response methods performed all electron atomic natural orbital ANO basis set contracted s p d f g manganese together cc pVTZbasis set oxygen atoms all electron correlated calculations invoked orbital frozen core s Mn s s p s p Trial calculations correlating orbitals minor effect excitation energies comparison EOM CCSD method cc pVTZ basis atoms tested compare LR CCSD formally give exactly excitation energies although transition moments accurate LR CCSD Abelian symmetry D used correlated excited state calculations ',

'Arrays TFTs circuits fabricated precleaned cm cm  $\mu$ m thick polyethylene naphthalate PEN substrates Dupont Teijin Full details vacuum fabrication procedures given previous publications Briefly aluminium gate electrodes associated tracks vacuum evaporated onto substrates shadow masks Subsequently substrates attached cooled web coater drum Aerre Machines drum rotating linear speed m min vacuum flash evaporated TPGDA monomer vapour condensed onto substrates cross linked exposure situ plasma resulting smooth pinhole free films typically nm  $\mu$ m thick measured dielectric constant varying range circuit fabrication insulator patterned using shadow masks define rectangular areas separated mm gaps act vias interlayer metallic connections substrates transferred evaporator Minispectros Kurt Lesker integrated nitrogen glovebox vacuum deposition nm min DNTT onto insulator Without exposing substrates ambient air gold source drain metallisation layer deposited shadow mask evaporator ',

'sodium trimer long history theoretical experimental studies pioneering theoretical paper Martin Davidson published showed obtuse isosceles geometry lower energy linear conformation Several extended PES scans Na alkali trimers followed initial study employing DFT complete active space SCF configuration interaction approach based valence bond wave functions Recently applicability density functional theory DFT JT distorted systems also tested Na B X transition revisited well applying state averaged multi reference configuration interaction large active space order derive accurate non adiabatic coupling terms improved interpretation photoabsorption spectra ',

'decades vibronic coupling models served bridges connecting nuclear dynamics studies static studies electronic structure calculations vibronic coupling model simple polynomial expansion diabatic potential energy surfaces couplings expansion coefficients chosen eigenvalues potential operator map adiabatic potential surfaces diabatisation ansatz circumvents many problems describing non adiabatic systems also inspiration diabatisation scheme used modern direct dynamic methods include non adiabatic effects model Hamiltonian correctly approximate eigenvectors true Hamiltonian span totally symmetric irreducible representation IrRep point groups molecule belongs appropriate symmetric geometries recent times many articles demonstrated advantages using symmetry constructing analytic model potential s often context permutation inversion groups ',

'Alternatively H atom photodetachment intermediate radicals latter may serve reducing agents Evidence reported recent years pyridinyl radical PyH exceptionally strong reducing agent even reduce CO formaldehyde formic acid methanol suitable catalyzers albeit mechanisms reactions currently poorly understood theoretically predicted dissociation thresholds AcH AOH BAH radicals eV eV eV respectively see Fig predicted dissociation threshold pyridinyl radical much lower eV Pyridinyl thus significantly stronger reductant acridinyl related radicals therefore expected latter able reduce carbon dioxide dark reactions ',

'Nanoparticle Tracking Analysis NTA applied characterising soot agglomerates particles c

compared Transmission Electron Microscopy TEM soot nanoparticles extracted used oil drawn sump light duty automotive diesel engine samples prepared analysis diluting heptane Individual tracking soot agglomerates allows size distribution analysis size soot compared length measurements projected two dimensional TEM images agglomerates techniques show soot in oil exists agglomerates average size nm NTA able measure particles polydisperse solutions reports size volume distribution soot in oil aggregates advantages fast relatively low cost compared TEM Nanoparticle Tracking Analysis NTA applied characterising soot agglomerates particles compared Transmission Electron Microscopy TEM Soot nanoparticles extracted used oil drawn sump light duty automotive diesel engine samples prepared analysis diluting heptane Individual tracking soot agglomerates allows size distribution analysis size soot compared length measurements projected two dimensional TEM images agglomerates techniques show soot in oil exists agglomerates average size nm NTA able measure particles polydisperse solutions reports size volume distribution soot in oil aggregates advantages fast relatively low cost compared TEM ',

'Fig shows wear mode map RH ceramics early stage friction coefficients surface roughness pure surface chosen value fracture toughness RH ceramics calculated based reference data literature Sc RH ceramics smaller Sc critical tested conditions initial stage friction Thus initial wear mode RH ceramics powder formation plowing addition powder formation plowing distinguished using dimensionless parameter Sc critical parameter Sc critical Sc HvRmaxKIC Sc critical  $\mu$ where Hv Vickers hardness RH ceramics Pa initial wear mode RH ceramics determined powder formation tested conditions demonstrated Fig Furthermore wear mode map cycles constructed shown Fig b map plots moved near transition curve plowing particular plots RH ceramics sliding stainless steel Al O balls nearer SiC Si N balls Therefore RH ceramics sliding SiC Si N balls showed relatively higher wear counterpart materials Nevertheless results wear mode maps indicated wear mode RH ceramics powder formation accompanied microcracks tested conditions study resulting low wear mm N Indeed observation worn surfaces revealed catastrophic wear RH ceramics accompanied large brittle fracture prevented overall shown Fig ',

'lateral force Q measured recorded throughout entire test piezoelectric load cell connected quasi stationary LSMB LSMB mounted flexures provide flexibility horizontal direction majority lateral force transmitted though much stiffer load path contains load cell shown Fig displacement load sensors calibrated externally in situ static conditions load displacement signals sampled rate two hundred measurements per fretting cycle fretting frequencies data used generate fretting loops loops used derive contact slip amplitude energy coefficient friction cycle according method suggested Fouvry et al Average values calculated test average coefficient friction included values associated initial transients tests suggested Hirsch Neu ',

'already discussed dilute flows choice hard sphere soft sphere models largely depends computational time spent solve particle equation motion dilute flows hard sphere model natural choice However collisions longer assumed binary instantaneous soft sphere model realistic option interesting know whether choice collision model affects statistics Fig compares mean velocity obtained models experimental data comparison performed smooth walls differences hard soft sphere models smooth walls almost negligible However differences hard soft sphere models rough walls minor rough wall treatment soft sphere implementation adds extra virtual walls collision particle wall realistic representation rough wall compared hard sphere rough wall treatment one random wall considered soft sphere collision instantaneous occurs finite amount time Similarly effects observed fluid statistics However Fig compares particle velocity fluctuations shows differences somewhat larger Additionally differences particle mean RMS velocity profiles hard sphere collisions unfortunately heavily dependent tangential coefficient restitution  $\psi$  effects varying quantity shown Figs ',

'current CLSVOF method normal vector calculated directly discretising LS gradient using finite difference scheme appropriately choosing one three finite difference schemes central forward backward differencing demonstrated thin liquid ligaments well resolved see Xiao Although high order discretisation scheme e.g. 5th order WENO found necessary LS evolution pure LS methods reduce mass error low order LS discretisation schemes 2nd order used produce accurate results LS equation solved constrained indicated CLSVOF method see Xiao since VOF method maintains 2nd order accuracy reason adopt CLSVOF method used following simulations liquid jet primary breakup ',

'present work LIF technique applied investigation gas sheared film flow horizontal rectangular duct technique makes possible perform field measurements local film thickness resolved space time similar work Alekseenko et al flat shape large transverse size duct allows resolve film thickness transverse coordinate well Alekseenko et al attempted annular downward flow technical reasons sampling frequency high enough experiments recently Alekseenko et al showed LIF technique also detect entrained droplets technique allows simultaneous study three dimensional wavy structures liquid entrainment improve understanding entrainment phenomenon ',

'general liquid film flows practical relevance turbulent hence associated presence broadband interfacial waves film surface thorough understanding characteristic profiles scales dynamics interfacial waves essential importance making accurate reliable predictions heat mass transfer rates MathieMarkides a Mathie et al Previous efforts downwards annular flow focused spatio temporal measurement liquid film thickness followed in depth statistical analyses film thickness Webb Hewitt Belt et al Alekseenko et al Zhao et al efforts contri

puted much improved understanding interracial topology observed downwards annular flows a lso subsequent proposal series correlations quantification mean film thickness wave ampli tudes liquid entrainment rates gas phase Ambrosini et al Karapantsios Karabelas Azzopardi hand less published velocity distribution flow structure within liquid films underneath f ilm surface related relative difficulty measurements caused extremely restricted measurem ent space due small thickness liquid films order often sub mm ii highly disturbed intermi ttent nature gas liquid interface iii entrainment gas inside liquid film liquid gas core iv relatively high velocities gas liquid phases ',

'aim paper investigate influence particle shape interacting particles flowing horizontal turbulent channel flow particles significant Stokes number achieve large eddy simulations LES horizontal turbulent channel flow laden five different particle shapes incorporating drag lift torque model derived Zastawny et al performed well documented horizontal channel flow case described Kussin Sommerfeld study spherical particles used reference case measu rements work done phase Doppler anemometry PDA measure fluid particle velocity simultaneo usly numerical framework applied paper previously validated spherical particles Mallouppa s van Wachem paper shown comprehensive discrete element model DEM accurate determining be haviour particles horizontal gas solid channel flow hard sphere model Moreover paper show ed fluid mechanics accurately modelled using LES framework current paper framework extend ed account non spherical particles ',

'also lack agreement constitutes churn flow fairly certainly gas continuous flow growing agreement huge waves present liquid carried drops Sekoguchi Mori Sawai et al using measur ements multiple probes axial length obtained time axial position void fraction informatio n able identify huge wave amongst disturbance waves slugs classified individual structure s huge waves size together fact velocities depended significantly corresponding axial len gth contrast disturbance waves velocity individual waves increased slightly axial extent waves also found frequency huge waves first increased decrease increasing gas superficial velocity Similarly velocities found deviate line slug flow velocities pass maximum minimu m ',

'developed theory electrons carrying quantized orbital angular momentum make connection realistic situations considered plane wave moving along optic axis lens system intercepte d round centered aperture In experiment aperture carries holographic mask turns movement along optic axis separated reduced Schrödinger equation operating plane aperture mapped o nto Bessel s differential equation ensuing eigenfunctions fall families discrete orbital angular momentum  $\hbar m$  along optic axis magnetic quantum number vortices produced matching p lane wave passage holographic mask fork dislocation eigenfunctions cylindrical problem Vo rtices focussed magnetic lenses volcano like charge distributions narrow angular divergen ce resembling loop currents diffraction plane Inclusion spherical aberration changes ring like shape destroy central zero intensity vortices m Partial coherence incident wave lead s rise central intensity minimum shown small source angle i e high coherence necessary ke ep volcano structure intact small angular width far field may allow creation nm sized sma ller electron vortices demand extremely high coherence source poses serious difficulty ',

'methods use D radial profiles obtained circular averaging D experimental PSD elliptical averaging inadequacy circular averaging neglects astigmatism Astigmatism distorts circula r shape Thon rings thus decreases modulation depth obtained D profile algorithms consider astigmatism involve concepts dividing PSD sectors Thon rings approximated circular arcs a pplying Canny edge detection find rings prior elliptical averaging determining relationsh ip D circular averages without astigmatism using brute force scan database containing pre calculated patterns ATLAS approaches estimating CTF parameters fully D PSD optimization u sually regulate fit numerous parameters extensive search guarantee convergence Furthermor e schemes developed defocus estimation provide error analysis ',

'scheduling process adopt matches multiple stage stochastic programming approach Standar d two stage stochastic programs linear convex functions often solved using L shaped metho d Bender s decomposition However recourse decision scheduled cancellations still anticipa tive uncertainty namely second shift surgery durations unavailability cancellations decis ion problem viewed three stage recourse model Solving scheduling problem complicated reco urse function integer Laporte Louveaux propose modified L shaped decomposition adjusted o ptimal cuts two stage stochastic program integer recourse Angulo et al alternately genera te optimal cuts linear sub problem integer sub problem improves practical convergence see also follow sample average approximation approach SAA uses framework Moreover prove explo it specific relationship first stage realization optimal number scheduled cancellations s peed computation integer cuts use Jensen s inequality upper bound minus second third stag e cost technique proposed Batun et al ',

'Traditionally archaeologists recorded sites artefacts via combination ordinary still ph otographs D line drawings occasional cross sections Given constraints attractions D model s obvious time digital photogrammetry laser scanners offering two well known methods data capture close range e g Bates et al Hess Robson highest specification laser scanners stil l boast better positional accuracy greater true colour fidelity SfM MVS methods James Rob son latter produce good quality models nonetheless many unique selling points Unlike trad itional digital photogrammetry little prior control camera position necessary unlike lase r scanning major equipment costs setup involved However key attraction SfM MVS required i nput taken anyone digital camera modest prior training required number overlap photograph s whole series traditional bottlenecks thereby removed recording process large numbers ar

chaeological landscapes sites artefacts captured rapidly field laboratory museum Fig a c shows examples terracotta warrior models level surface detail considerable ',

'Modeling collaboration processes challenging task Existing modeling approaches capable expressing unpredictable non routine nature human collaboration influenced social context involved collaborators propose modeling approach considers collaboration processes evolution network collaborative documents along social network collaborators modeling approach accompanied graphical notation formalization allows capture influence complex social structures formed collaborators therefore facilitates activities discovery socially coherent teams social hubs unbiased experts demonstrate applicability expressiveness approach notation discuss strengths weaknesses ',

'start outlining motivation structure content review long known cardiovascular signals contain number oscillatory components exactly periodic put differently periods frequencies fluctuate time example heart rate variability HRV provided major topic discussion introduce one statistical approaches HRV Section However order understand variability cardiovascular system discussion single source insufficient cardiovascular system composed many different physiological components subsystems effects mutual interaction combine produce HRV demonstrated Section revealed results obtained using wavelet transform Section discuss cardio respiratory interaction terms phase synchronization set scene later discussions summarize basic principles phase dynamics Section readers unfamiliar physiological aspects research provide Appendices cardiovascular system B measurements cardiovascular signals conducted Appendix C provides details statistical methods used group data analyses ',

'early s following golden age general relativity took place s wide array candidate theories gravity existence could rival Einstein formalism needed deal great abundance possibilities provided form Parameterised Post Newtonian PPN formalism Kenneth Nordtvedt Kip Thorne Clifford PPN formalism built earlier work Eddington Dicke allowed numerous theories available time compared cutting edge astrophysical observations lunar laser ranging radio echo Hulse Taylor binary pulsar PPN formalism provided clear structure within one could compare assess various theories benchmark theories gravity evaluated ever since give outline PPN formalism constraints available within today Section ',

'Despite ubiquity time dependent dynamical systems nature relatively little work done analysis time series systems Mathematically known non autonomous systems named unlike autonomous systems addition points space observed also influenced points time Recently much work direct bottom up approach systems includes introduction subclass known chronotaxic systems able model stable time varying frequencies oscillations living systems contrast time series analysis systems referred inverse top down approach studied detail partly non autonomous systems still analysed way types systems deterministic stochastic regime However argued type analysis insufficient entirely new analytical framework required provide useful picture systems case chronotaxic systems methods already developed inverse approach shown useful analysing heart rate variability general dedicated procedure analysing non autonomous systems still tackled though ',

'Recent astronomical observations high redshift type Ia supernovae performed two groups well power spectrum cosmic microwave background radiation obtained BOOMERANG MAXIMA experiments seem indicate present Universe state accelerated expansion one analyzes data within Friedmann Robertson Walker FRW standard model cosmology natural interpretation Universe spatially flat baryonic plus dark matter density  $\rho$  one third critical density  $\rho_{crit}$  interestingly dominant contribution energy density provided cosmological constant  $\Lambda$  vacuum energy density  $\rho_{\Lambda}$   $\Lambda$   $\mu\text{G}$  twice large  $\rho$  i e two thirds critical density  $\Omega_M$   $\rho_{crit}$   $\Omega_{\Lambda}$   $\rho_{crit}$   $\Omega_{tot}$   $\Omega_M$   $\Omega_{\Lambda}$   $\Omega_M$   $\Omega_{\Lambda}$   $\Omega_{tot}$  implies deceleration parameter  $q$  approximately originally cosmological constant problem related question  $\Lambda$  unnaturally small discovery important role played  $\rho_{\Lambda}$  shifted emphasis toward coincidence problem question  $\rho$   $\rho_{\Lambda}$  happen order magnitude precisely moment ',

'First results RHIC charged multiplicities evolution multiplicities centrality particle ratios transverse momentum distributions central minimum bias collisions analyzed string model includes hard collisions collectivity initial state considered string fusion rescattering produced secondaries Multiplicities evolution centrality successfully reproduced Transverse momentum distributions model show larger  $p_T$  tail experimental data disagreement grows increasing centrality Discrepancies particle ratios appear examined comparing previous features model SPS First results RHIC charged multiplicities evolution multiplicities centrality particle ratios transverse momentum distributions central minimum bias collisions analyzed string model includes hard collisions collectivity initial state considered string fusion rescattering produced secondaries Multiplicities evolution centrality successfully reproduced Transverse momentum distributions model show larger  $p_T$  tail experimental data disagreement grows increasing centrality Discrepancies particle ratios appear examined comparing previous features model SPS ',

'section wish calculate cross section absorption massless scalars self dual string world volume M theory five brane adopt entirely world volume approach similar begin writing equation satisfied s wave energy  $\omega$   $\phi$   $r$   $\phi$   $r$  ei $\omega t$  linear fluctuations four overall transverse scalars self dual string known problems one considers higher angular momentum modes one must take care validity linearized approximation discussed  $\rho$   $dd\rho$   $dd\rho$   $R$   $\omega$   $\rho$   $\phi$   $\rho$   $\rho$   $r\omega$   $R$   $Q$   $\ell$  p Note pointed world volume solitons much sharper potential Coulomb type potential typical brane solutions supergravity thus scattering different string six dimensional supergravity Nevertheless small  $\omega R$  one may solve problem matching approximate solution inner region

n approximate solution outer region follows closely supergravity calculation ',  
 'consider cosmological consequences conformal invariant formulation Einstein's General Relativity instead scale factor spatial metrics action functional massless scalar dilaton field occurs scales masses including Planck mass Instead expansion universe obtain Hoyle Narlikar type mass evolution temperature history universe replaced mass history show conformal invariant cosmological model gives satisfactory description new supernova Ia data effective magnitude redshift relation without cosmological constant make prediction high redshift behavior deviates standard cosmology z We consider cosmological consequences conformal invariant formulation Einstein's General Relativity instead scale factor spatial metrics action functional massless scalar dilaton field occurs scales masses including Planck mass Instead expansion universe obtain Hoyle Narlikar type mass evolution temperature history universe replaced mass history show conformal invariant cosmological model gives satisfactory description new supernova Ia data effective magnitude redshift relation without cosmological constant make prediction high redshift behavior deviates standard cosmology z ',

'Production charmonium states  $J/\psi$  nucleus nucleus collisions studied CERN SPS previous years NA NA Collaborations experimental program mainly motivated suggestion use  $J/\psi$  probe state matter created early stage collision original picture see also modern review assume s charmonia created exclusively initial stage reaction primary nucleon nucleon collisions subsequent evolution system number hidden charm mesons reduced absorption pre resonance charmonium states nuclear nucleons normal nuclear suppression b interactions charmonia secondary hadrons comovers c dissociation cc bound states deconfined medium anomalous suppression found  $J/\psi$  suppression respect Drell Yan muon pairs measured proton nucleus nucleus nucleus collisions light projectiles explained so called normal due sweeping nucleons nuclear suppression alone contrast NA experiment heavy projectile target Pb Pb revealed essentially stronger  $J/\psi$  suppression central collisions anomalous  $J/\psi$  suppression attributed formation quark gluon plasma QGP comover scenario excluded ',

'Brodsky Lepage proposed formula meson pair production looks similar except different charge factor appearance timelike electromagnetic meson form factor instead annihilation form factor R formula obtained leading twist result neglecting part amplitudes opposite photon helicities pointed part however approximately independent pion distribution amplitude generically small also remark appearance  $F_{\pi} \gamma\gamma \pi\pi$  amplitude longer observed corrections partonic transverse momentum hard scattering process taken account corrections numerically small values dealing Notice two photon annihilation produces two pions C even state whereas electromagnetic form factor projects C odd state pion pair contrast annihilation for m factor R  $\pi$  C even discussed Finally due particular charge factor Brodsky Lepage formula leads vanishing cross section  $\gamma\gamma$  annihilation pairs neutral pseudoscalars ',

'Since perturbative expansion used impossible find exact bounds instead one derive tree level unitarity bounds loop improved unitarity bounds study use unitarity bounds coming tree level analysis tree level analysis derived help equivalence theorem high energy approximation assumed energy scale much larger Z W gauge boson masses consider high energy hypothesis equivalence theorem decoupling regime well settled way unitarity constraint also fulfilled purpose investigate quantum effects decays light CP even Higgs boson h especially looking sizeable differences respect SM decoupling regime ',

'bag model linear harmonic oscillator confining potentials first excited S state lies lowest P state making predicted Roper mass heavier lightest negative parity baryon mass Pairwise spin dependent interactions must reverse level ordering mentioned earlier color spin interactions fail regard flavor spin interactions produce desired effect Since q color wave function antisymmetric flavor spin orbital wave function totally symmetric quarks S state flavor spin wave function totally symmetric leads attractive flavor spin interaction one quark P state orbital wave function mixed symmetry flavor spin wave function flavor spin interaction less attractive SU 6 symmetric case Eq one obtains mass splittings  $\Delta M_{\chi} C_{\chi} N N C_{\chi} \Delta C_{\chi} N$  approximated N state total quark spin ',

'measurements presented provide evidence existence di cluster structures Be Certainly breakup process samples overlap wavefunctions ground state excited states first chance cluster breakup cross sections shown Fig indicate xHe A xHe cluster structure decrease mass range A Given also decay energy threshold increases mass number present data may even indicate slight increase clustering breakup cross sections also appear demonstrate nuclei possess stronger structural overlap  $\alpha$  Xn  $\alpha$  configuration although reaction mechanics final state reached may complex say dominant structural mode neutron rich isotopes may identified two alpha particles plus valence neutrons comprehensive measurements neutron removal cluster breakup first time provide experimental data whereby structure neutron rich isotopes modeled via reactions ',

'Let us consider case beta beam source Similarly case static tritium source advantage beta beams neutrino fluxes accurately calculated Fig shows electron neutrino scattering events range MeV MeV keV keV respectively Fig b rounded nearest integer number counts shape flux averaged cross sections similar reactor case reflected event rates shown figures seen measuring electron recoils keV range beta beam source one could sufficiently strong source clear signature neutrino magnetic moment  $\mu_B$  figures Helium ions however similar results obtained using neutrinos Ne results shown obtained intensity  $\nu$  s i e ions s magnetic moment intensity produce events MeV MeV range per year events keV keV range per year numbers increase respectively case magnetic moment  $\mu_B$  ',

'purpose Letter answer question confront six zero textures lepton mass matrices latest experimental data First shall present concise analysis lepton mass matrices Table reveal isomeric features namely phenomenological consequences although structures apparently different Second shall examine predictions lepton mass matrices comparing  $\sigma$   $\sigma$  intervals two neutrino mass squared differences three lepton flavor mixing angles To specific make use  $\sigma$   $\sigma$  intervals two neutrino mass squared differences three lepton flavor mixing angles given M Maltoni et al Ref obtained global analysis latest solar atmospheric reactor KamLAND CHOOZ accelerator K K neutrino data find parameter space allowed six isomeric lepton mass matrices  $\sigma$  level  $\sigma$  level however results neutrino masses lepton flavor mixing angles compatible current data Third incorporate seesaw mechanism Fukugita Tanimoto Yanagida hypothesis charged lepton Dirac neutrino mass matrices six texture zeros turns predictions including  $\theta$  good agreement present experimental data even  $\sigma$  level ',

'aim note nothing bring approaches equal footing relax assumptions results derived using first approach concretely generalize one loop partition functions derived levels odd case even levels Moreover level partition functions implement additional dressings world sheet parity symmetry identify dressings introduced crosscap state approach expected physical information read entirely various amplitudes end collection explicit general one loop partition functions tadpole cancellation conditions covering simple current extensions Gepner models additional dressings parity symmetry fact providing compact collection main relevant formulas constructing supersymmetric Gepner model orientifolds one motivations writing Letter hope expressions turn useful systematic search Standard like models respectively providing statistical ensemble spirit ',

'Absorption events charged current reactions  $\nu_e$  Ar  $\nu_e$  K and  $\nu_e$  Ar  $\nu_e$  Cl uncertainty predicting  $\nu_e$  event rates processes arise due nuclear model dependencies absorption cross section treatment Coulomb distortion electron positron field residual nucleus nuclear absorption cross section charged current neutrino reactions Ar relevant supernova neutrino energies first calculated Raghavan Bahcall et al Fermi transitions leading isobaric analogue state IAS MeV K Later Ormand et al used shell model calculate Fermi Gamow Teller transitions calculations Fermi function  $F(Z, E_e)$  used take account Coulomb effects recent paper Bueno et al make use calculation Martinez Pinedo et al use shell model Fermi Gamow Teller transitions continuum random phase approximation CRPA forbidden transitions calculate absorption cross sections calculation Coulomb distortion produced electron treated hybrid model Fermi function used lower electron energies modified effective momentum approximation MEM A higher electron energies recent work Bhattacharya et al measured Fermi Gamow Teller transition strengths leading excited states MeV K obtained neutrino absorption cross section supernova neutrinos Ar ',

'Classical two dimensional sigma models compact symmetric spaces  $G/H$  integrable virtue conserved quantities arise integrals local non local functions underlying fields accounts contain references extensive literature Since models asymptotically free strongly coupled infrared quantum properties straightforward determine Nevertheless following Lüscher Abdalla Forger Gomes showed  $G/H$  sigma model  $H$  simple Here throughout Letter shall use simple mean corresponding Lie algebra non trivial ideals Hence  $U$  simple terminology addition usual non Abelian simple groups Cartan Killing classification first conserved non local charge survives quantization appropriate renormalization suffices ensure quantum integrability theory contrast calculations using  $N$  expansion reveal anomalies spoil conservation quantum non local charges CPN  $SU(N)$   $SU(N)$   $U(N)$  models  $N$  wider class theories based complex Grassmannians  $SU(N)$   $SU(n)$   $SU(N)$   $U(N)$  ',

'propose method lattice QCD computation nucleon nucleon low energy interactions consists simulating QCD background electromagnetic field whose potential non vanishing whose field strength zero tuning background field phase shifts small momenta determined measuring shift ground state energy Lattice sizes small Fermi sufficient calculation phase shifts momenta order  $m\pi$  ',

'study illustrate properties gauge invariant extensions local functionals aim clarifying via specific examples relation functional local particular gauge necessarily gauge invariant gauge invariant extension necessarily local show non localities found perturbatively local expressed terms infinite derivative expansion believe implications observation clearly emphasised literature attested absence debate recent works precisely dangerous infrared modes make hard define gauge independent renormalisation gauge invariant extensions local functionals observation supports remark expectation value receives important contributions large small distances arguments renormalisability based notion renormalisation modern sense relies BRST cohomology theorems BRST terminology therefore frequently used even though always necessary ',

'Certainly therefore see saw mechanism attractive explanation light neutrino masses small However without faults particular tension strongly hierarchical nature observed Yukawa couplings quark charged lepton sectors essentially hierarchy free masses implied  $\Delta m$  s Moreover  $\theta$   $\theta$  mixing angles large angle  $\theta$  small sharp contrast corresponding mixings quark sector small problems solved specific models example  $\Delta m$  values fitted taking spectrum rhon neutrino masses hierarchical way almost compensate hierarchical neutrino Yukawa couplings price introducing wide range rhon neutrino masses MR require explanation ',

'analyze diagonal transition magnetic electric dipole moments charged leptons extended technicolor ETC models taking account multiscale nature ETC gauge symmetry breaking conformal walking behavior technicolor theory mixing charged lepton mass matrix show mixing eff



ects dominate ETC contributions charged lepton electric dipole moments yield value de com parable current limit rate  $\mu$  ey also close limit processes derive constraints charged lep ton mixing angles constraints ETC contribution muon anomalous magnetic moment includes si gnificant lepton mixing term approach exceed current sensitivity level ',

'well known one long standing problems physics understanding confinement physics first p rinciples Hence challenge develop analytical approaches provide valuable insight theoreti cal guidance According viewpoint effective theory confining potentials obtained consequen ce spontaneous symmetry breaking scale invariance developed particular shown theory relie s scale invariant Lagrangian type  $L = \bar{\psi} i \not{D} \psi + \frac{1}{4} F_{\mu\nu}^2 + \bar{\psi} \psi$  w fundamental field rather function index field strength  $w = \frac{1}{2} \epsilon_{\mu\nu\alpha\beta} F_{\mu\nu} F_{\alpha\beta}$  equation motion leads  $\epsilon_{\mu\nu\alpha\beta} \partial_\mu F_{\nu\alpha} = 0$  integrated w  $F_{\mu\nu} F_{\mu\nu} = M^2$  easy verify  $\partial_\mu F_{\mu\nu} = 0$  equation motion leads us  $\partial_\mu F_{\mu\nu} = M^2 F_{\mu\nu}$   $F_{\alpha\beta} F_{\alpha\beta}$  worth stressing stage equation obtained effective Lagrangian  $\mathcal{L}_{eff} = \bar{\psi} i \not{D} \psi + \frac{1}{4} F_{\mu\nu}^2 + \bar{\psi} \psi$  Spherically symmetric solutions Eq display even Abelian case Coulomb piece confinin g part Also quantum theory calculation static energy two charges displays behavior well k nown square root part describes string like solutions ',

'supersymmetric case small coupling quartic interaction realized potential lifted gauge D term interactions since coupling constant  $\lambda$  becomes order  $g$   $g$  gauge coupling constant s tandard model Therefore focus attention D flat directions D flat directions careful since behaviors potential depend flat direction consider MSSM Yukawa interactions exist superpo tential generate fermion masses Yukawa interactions lift D flat directions addition also find several D flat directions affected Yukawa interactions associated fermion masses wit hout R parity violation D flat directions lifted effects supersymmetry breaking Here assu me coefficients non renormalizable terms suppressed enough neglected may explained R symm etry assigning R charge MSSM chiral superfields See Ref details ',

'non standard couplings determined could also studied standard e e option linear collide r Therefore worth compare potential power two options far parameter  $\alpha_Y$  concerned  $\gamma\gamma$  colli der allow determination could determined e e second tt  $\gamma$  coupling  $\alpha_Y$  proportional real pa rt top quark electric dipole moment See taking account operators  $O_{uB}$   $O_{qB}$   $O_{qW}$  redundant me asured recalled energy polar angle distributions leptons b quarks e e colliders sensitive imaginary partelectric dipole moment However emphasized exist observables sensitive also real part top quark electric dipole moment see real part could determined measurement  $\gamma\gamma H$  couplings e e colliders course useless bX final state  $q\bar{q}$   $q\bar{q}$  could measured case decay for m factor  $\alpha_d$  measurement e e option seems little advantageous especially e e polarization tuned appropriately ',

'contrast H particle situation  $\Theta$  baryon promising Thus Letter explore formation  $\Theta$  baryon within new approach called parton based Gribov Regge theory realized Monte Carlo program NEXUS model high energy hadronic nuclear collisions treated within self consistent quantu m mechanical multiple scattering formalism Elementary interactions happening parallel cor respond underlying microscopic predominantly soft parton cascades described effectively p henomenological soft pomeron exchanges pomeron seen layers soft parton ladder attached pr ojectile target nucleons via leg partons high energies one accounts also contribution per turbative high pt partons described so called semihard pomeron a piece QCD parton ladder sandwiched two soft pomerons connected projectile target usual way spectator partons proj ectile target nucleons left pomeron emissions form nucleon remnants legs pomerons form co lor singlets  $q\bar{q}$   $q\bar{q}$   $q\bar{q}$   $q\bar{q}$  probability  $q\bar{q}$   $q\bar{q}$   $q\bar{q}$  controlled parameter  $P_{qq}$  fixed experim ental yields multi strange baryons ',

'hit position inside drift chambers calculated drift time digitized flash analog to digi tal converter calculation carried based relation hit position drift time  $x$   $t$  relation  $x$   $t$  relation precisely calculated drift chamber simulation package GARFIELD gas property simu lation package MAGBOLTZ Although chambers constructed carefully tolerance  $\mu m$  small positi on deviation wires field shaping patterns could locally modify electric field order take account limited accuracy chamber manufacturing correction commonly applied calculated  $x$   $t$  relation throughout experiments correction obtained minimize  $\chi^2$  fitting straight tracks cl ean muon events observed ground without magnetic field correction small expected accuracy chamber manufacturing observations  $x$   $t$  relation affected variation pressure temperature c hamber gas order take account time dependent variations  $x$   $t$  relation calibrated data taki ng run Especially calibrating  $x$   $t$  relation ODCs absolute reference positions provided Sci Fi affected variation pressure temperature ',

'also could resist mentioning another wild speculation Many years ago inspired almost ex act correspondence Einstein s post Newtonian equations gravity Maxwell s equations motion proposed gravitipole analogy Dirac s magnetic monopole Dirac considerable debate field th eory magnetic monopoles may formulated Eventually t Hooft Polyakov showed magnetic monopo le exists extended solution certain non abelian gauge theories theorists believe electrom agnetism merely piece grand unified theory magnetic monopoles exist Might turn Einstein s theory piece bigger theory gravitipoles exist grand unified theory electromagnetic field component multiplet Could gravitational field also somehow carries internal index field o bserve component multiplet Throwing caution wind also asked gravitipole graviton might fo rm representation dual group magnetic monopole photon form triplet dual group Montonen Ol ive ',

'summary shown one describe experimental data HERMES Collaboration hadron attenuation nu clei without invoking changes fragmentation function due gluon radiation dynamical studie s include relevant FSI employ free fragmentation function nucleon attribute hadron attenu

ation deceleration produced pre hadrons due FSI surrounding medium find particular z dependence RMh sensitive interaction cross section leading prehadrons used determine olead in teraction leading prehadrons formation time could interpreted in medium change fragmentat ion function however could given closed form extracted average hadron formation times  $\tau_f$  fm c compatible analysis antiproton attenuation p A reactions AGS energies upcoming work investigate detail spectra different particle species  $\pi$  K p p examine formation times mes ons antibaryons equal addition improve model describe primary photon nucleon reaction PYT HIA threshold W GeV ',

'Solitons present possibility extended objects stable states within Quantum Field Theory Although solutions obtained semi classical arguments weak coupling limit validity quantal states justified based associated topological conservation laws curious occurrence fermio nic zero energy modes trapped solutions presence requires according well known arguments assignment half integer fermion number solitonic states usual treatment back reaction fer mion zero modes soliton ignored However fractional values fermionic charge interesting co nsequence fate soliton latter strictly stable reason configuration relax trivial vacuum i solation particle like state available carrying fractional value fermionic charge Dynamic al stability objects pointed cosmological context recently Fractional fermion number phen omenon also occurs condensed matter systems wide ranging implications call systematic und erstanding phenomenon ',

'charmonium production long considered good process investigating perturbative nonpertur bative properties quantum chromodynamics QCD relatively large difference scale charm quar k pair produced parton level scale evolves quarkonium particular comparing hadron collide rs e e colliders provide cleaner environment study charmonium productions decays However puzzles arise recent measurements prompt  $J/\psi$  productions BaBar Belle inclusive  $J/\psi$  produc tions cross section much larger predictions nonrelativistic quantum chromodynamics NRQCD also over abundance four charm quark processes including exclusive  $J/\psi$  charmonium product ions apparent signal hard  $J/\psi$  spectrum predicted  $J/\psi g g$  production mode well color octet m echanism NRQCD provide plausible solutions explanations conflicts theorists studied possi bilities contribution two virtual photon mediate processes large higher order QCD correct ions collinearsuppression end point region  $J/\psi$  momentum contribution  $J/\psi$  glueball associ ated production contribution light scalar boson ',

'States outside constituent quark model hypothesized exist almost since introduction col or Hybrid mesons qq states admixture gluons glueballs states quark content rely self inte raction property gluons due color charge Looking glueballs would obvious way find evidenc e states constituent gluons however search hindered fact states may significantly mix reg ular qq mesons region lightest predicted occur may observable pure states disentangling o bserverd spectra may difficult task Instead hybrid mesons qq gn may better place search ev idence resonances outside constituent quark model especially since lightest theses states predicted exotic quantum numbers spin parity charge conjugation JPC combinations unattain able regular qq mesons ',

'define new multispecies model Calogero type dimensions harmonic two body three body int eractions Using underlying conformal SU algebra indicate find complete set states Bargman n Fock space towers states equidistant energy spectra tower explicitly construct polynom ial eigenstates namely center of mass states global dilatation modes find corresponding e igenenergies also construct ladder operators global collective states Analysing correspon ding Fock space detect universal critical point model exhibits singular behavior results universal systems underlying conformal SU symmetry We define new multispecies model Calog ero type dimensions harmonic two body three body interactions Using underlying conformal SU algebra indicate find complete set states Bargmann Fock space towers states equidistan t energy spectra tower explicitly construct polynomial eigenstates namely center of mass states global dilatation modes find corresponding eigenenergies also construct ladder ope rators global collective states Analysing corresponding Fock space detect universal criti cal point model exhibits singular behavior results universal systems underlying conformal SU symmetry ',

'Correlation charm quark charm antiquark  $\gamma p$  scattering calculated kt factorization appro ach apply different unintegrated gluon distributions uGDF used literature results calcula tions compared recent experimental results FOCUS Collaboration CCFM uGDF developed recent ly Kwieciński et al gives good description data New observables suggested future studies Predictions perspectives HERA energies presented ',

'expression  $P_c$  also easily found basis becomes apparent dynamics conversion matter depen ds relative orientation eigenstates vacuum matter Hamiltonians allows directly apply know n analytical solutions  $P_c$  upon rotating back obtain generalization results NSI case examp le answer infinite exponential profile  $A \exp r/r$  becomes  $P_c \exp \gamma \cos \theta_{rel} \exp \gamma \gamma \pi r \Delta \pi r \Delta m E \nu$  observe since  $\gamma$  adiabaticity violation occurs  $\theta \propto \phi \pi$  analogue small angle MSW ef fect rotated basis resonant region Sun level jumping take place narrow defined  $A \Delta$  neutri no produced lower density evolves adiabatically neutrino produced higher density may unde rgo level crossing probability  $P_c$  latter case given good accuracy formula linear profile appropriate gradient taken along neutrino trajectory  $P_c \Theta A \Delta e \gamma \cos \theta_{rel} \Theta x$  step funct ion  $\Theta x x \Theta x$  otherwise emphasize results differ similar ones given three important respe cts valid small values  $\alpha$  essential application ii include angle  $\phi$  iii argument  $\Theta$  function contain  $\cos \theta$  follows stress large values  $\alpha \phi \pi$  adiabaticity violated large values  $\theta$  ',

'One major goal current nuclear physics observation least partial restoration chiral sym

metry since chiral order parameter  $q$  expected decrease already normal nuclear matter density in medium change due dropping quark condensate principle observable photonuclear reactions conjecture partial restoration chiral symmetry causes softening narrowing  $\sigma$  meson chiral partner pion nuclear medium led idea measuring  $\pi\pi$  invariant mass distribution near  $\pi$  threshold photon induced reactions nuclei contrast questionable nature proper quasiparticle vacuum  $\sigma$  meson might develop much narrower peak finite baryon density due phase space suppression  $\sigma\pi\pi$  decay hence making possible explore properties embedded nuclear many body system Measuring threshold enhancement  $\pi\pi$  invariant mass spectrum might serve signal partial restoration chiral symmetry inside nuclei therefore give information one fundamental features QCD',

'agreement new data calculations relativistic deuteron wave function considered accidental one connection results mentioned Previously shown calculations within framework light front dynamics Karmanov's deuteron wave function reasonably good agreement experimental data T parameter deuteron breakup H C targets emission protons  $k$  region GeV/c Furthermore within approach qualitative description momentum behaviour Ayy parameter Be p X reaction deuteron momentum GeV/c detected proton angle  $m_r$  rather good description Ayy data C p X reaction GeV/c  $m_r$  obtained',

'scenario proposed bi large lepton mixing framework nearly threefold degenerate Majorana neutrinos proposal impose Z symmetry neutrino sector high energy scale account threefold degenerate neutrinos maximal mixing  $\nu_\mu\nu_\tau$  order obtain atmospheric neutrino mass splitting keeping maximal mixing  $\nu_\mu\nu_\tau$  introduce small perturbation neutrino mass matrix without breaking Z symmetry hand solar neutrino mixing arises due non diagonal charged lepton mass matrix desirable large mixing mass splitting solar neutrino oscillation obtained radiative corrections',

'NJL model studied find stable stars either CFL normal quark matter cores opposite prediction Ref argued SC phase compact stars Let us precise performing Taylor expansion strange quark mass authors Ref found beta equilibrated electrically color neutral quark matter SC phase always less favored CFL phase normal quark matter observation concluded SC phase absent compact stars contrast result shown Ref framework NJL model neutral SC matter could favored quark phase certain regime However authors argued interval might disappear hadronic phase included properly indeed found parameter set RKH parameter set HK SC phase survives tiny window Nevertheless Nature chooses similar equation state tiny window gives rise hybrid stars whereas CFL phase would never present compact stars',

'investigate density behavior symmetry energy respect isospin equilibration combined systems Ru Zr Ru relativistic energies A GeV study performed within relativistic framework contribution iso vector scalar  $\delta$  field symmetry energy isospin dynamics particularly explored find isospin mixing depends symmetry energy stiffer behavior leads transparency results also nicely sensitive fine structure symmetry energy i.e covariant properties isovector meson fields The isospin tracing appears much less dependent medium neutron proton cross sections on  $p$  makes observable peculiar study isovector part nuclear equation state Within framework comparisons experiments support introduction  $\delta$  meson description isovector equation state',

'ambitious goal may stated one detecting location say one missing level otherwise complete sequence Dyson recent review uses information theory concepts argues correlations sequence may provide necessary redundancy error correcting codes constructed one extreme correlations therefore redundancy present Poissonian sequence possibility detecting one missing level extreme sequence equally spaced levels picket fence maximum redundancy missed level obviously detected hole spectrum Eigenvalues random matrices exhibit characteristic correlations correspond intermediate situation two extremes attempts locate last case single missed level remained unsuccessful far However mentioned two dimensional chaotic systems besides correlations order one mean spacing described random matrices presence long range correlations governed shortest periodic orbits reflected Weyl's law describing average spectral density well understood possible approximately locate study spectral fluctuations single missed level',

'reason investigate BFKL DGLAP equations case supersymmetric theories based common belief high symmetry may significantly simplify structure equations Indeed found leading logarithmic approximation LLA so called quasi partonic operators N SYM unified supermultiplets anomalous dimensions obtained universal anomalous dimensions  $\gamma_{n,j}$  shifting arguments in integer number anomalous dimension matrices twist operators fixed superconformal invariance Calculations maximally extended N SYM coupling constant renormalized give even remarkable results Namely turns twist operators enter multiplet anomalous dimension matrix fixed completely super conformal invariance universal anomalous dimension LLA proportional  $\Psi_j\Psi_m$  means evolution equations matrix elements quasi partonic operators multicolor limit  $N_c$  equivalent Schrödinger equation integrable Heisenberg spin model QCD integrability remains small sector quasi partonic operators case N SYM equations sets operators also integrable Evolution equations quasi partonic operators written explicitly super conformal form Ref',

'Thus extension charmed analogue  $\Theta_c$  provides interesting test SDO sum rule lattice calculations charm quark quite heavy constituent quark picture may fit well JW prediction parity expected reproduced QCD fact quenched lattice calculation finds parity  $\Theta_c$  positive extension  $\Theta_c$  sum rules two important aspects make sum rule different SDO sum rule First since charm quark heavy form quark condensate gives non perturbative effects radiating gluons

quark gluon mixed condensate  $\langle \bar{s}s \rangle$  is important contribution to sum rule replaced gluonic operators heavy quark expansion normally suppressed Secondly charm quark mass kept finite OPE done using momentum space expression charm quark propagator different light quark sum rule calculation performed coordinate space quark propagators obtained based expansion small quark mass Keeping two aspects mind construct QCD sum rules to see different sum rule',

'Including  $\alpha_s$  corrections operators listed included convenient framework carry calculations QCD factorization framework allows express hadronic matrix elements schematic form  $\langle V | O | B \rangle$  transition form factors defined matrix elements operator  $O$  leading twist B meson wave function  $\phi_B$  light cone component spectator quark momentum  $\phi_V$  leading twist light cone distribution amplitude LCDA transversely polarized vector meson  $V$  fractional momentum vector meson carried one two partons quantities  $T_1$   $T_2$  hard perturbative kernels calculated order  $\alpha_s$  latter containing so called hard spectator contributions factorization formula holds heavy quark limit i.e. order  $\Lambda_{QCD}^2$  MB factorization framework used calculate branching fractions related quantities decays  $B \rightarrow K \gamma$   $B \rightarrow \rho \gamma$  isospin violation  $B \rightarrow K \gamma$  decays framework also studied applications  $B \rightarrow K \gamma$  see Refs recently hard spectator contribution arising chromomagnetic operator  $O_8$  also calculated next to next to leading order NNLO  $\alpha_s$  showing spectator interactions factorize heavy quark limit However numerical effect resummed NNLO contributions marginal shall include update',

'Several methods based dynamical assumptions suggested determination P parity to According general theorem order determine parity one particle binary reaction one know polarizations least two fermions participating reaction Model independent methods determination P parity to suggested recently Refs pp collision Ref photoproduction to method Refs based assumption spin to equals suggests measure spin spin correlation parameter reaction  $p p \rightarrow \pi^0 n$  near threshold generalize method arbitrary spin to isospins T T NN channel NN  $Y \rightarrow$  reaction Furthermore consider polarization transfer nucleon hyperon reaction consideration model independent since based conservation P parity total angular momentum isospin reaction generalized Pauli principle nucleons',

'central question point view nuclear physics involves changes quark antiquark distributions bound proton Since one must develop reliable model free proton binding nucleons starting quark level problem rather complicated intend report investigation problem future work present chosen illustrate formal ideas developed applying toy model namely quark distributions isospin symmetric quark matter quark feels scalar potential  $V_s$  vector potential  $V_v$  premise Quark Meson Coupling QMC model used successfully calculate properties nuclear matter well finite nuclei recently also used derive effective nuclear force close widely used Skyrme III force Except QMC quarks confined MIT bag well feeling mean field scalar vector potentials generated surrounding nucleons mean field approximation Dirac equation quark infinite quark matter written  $i \gamma^\mu \partial_\mu \psi = (V_s + \gamma^0 \gamma^3 V_v) \psi$ ',

'Within coalescence approach successfully applied earlier light quark sector evaluated transverse momentum dependencies charmed hadrons central heavy ion reactions RHIC charm quark distributions hadronization considered two limiting scenarios i.e. reinteractions using spectra PYTHIA complete thermalization transverse flow bulk matter resulting  $J/\psi$  spectra differ slope factor harder pQCD c quarks integrated yield factor larger thermal case D mesons found difference slope parameters pT spectra two scenarios less pronounced elliptic flow factor larger pT GeV thermalized case elliptic flow pattern D mesons found essentially preserved single electron decay spectra rendering latter promising observable address strength charm reinteractions QGP present study straightforwardly generalized charmed baryons  $\Lambda_c$  may serve complimentary probe charm quark reinteractions QGP',

'One challenges quantum chromodynamics QCD relativistic bound state problem light cone Hamiltonian approach light cone wave functions constructed boost invariant way necessary reliable light cone wave functions one wants calculate high energy scattering especially exclusive reactions Many parametrizations assume separability dependence longitudinal momentum fraction transverse momentum unlikely since two momenta coupled kinetic energy operator Various approaches tried compute wave functions One use usual equal time Hamiltonian transform resulting wave functions light cone form help kinematical on shell equations light cone Hamiltonian string picture formulated Ref ambitious construction effective Hamiltonian including gauge degrees freedom explicitly solving bound state problem mesons approach still needs many parameters fixed Attempts made solve valence quark wave function mesons simple Hamiltonian two body potential',

'microwave background universal photon field taken consideration Especially interesting isotropic infrared optical background IRB number density IRB smaller MBR two orders magnitude hand protons lower energy interact IRB smaller number density weighted higher flux interacting protons present Universe optically thin eV lower energy protons even low redshifts proton interaction rate quickly increases different interactions MBR interacting protons quickly lose energy even z cosmological evolution UHECR injection thus major importance contribution interactions flux cosmogenic neutrinos',

'Letter extend McVittie's solution charged black holes first deduce metric Reissner Nordström black hole expanding universe several special cases solution exactly solutions discovered previously previous work applied asymptotic conditions derive Schwarzschild metric expanding universe exactly derived McVittie solving full Einstein equations demonstrates power simple straight forward approach Letter follow procedure derive metric Reissner Nordström black hole expanding universe',

astrom black holes Friedman Robertson Walker universe study influences evolution universe size black hole Finally order study motion planet rewrite metric cosmic coordinates system Schwarzschild coordinates system ',

'ART model hadronic transport model includes baryons  $N \Delta N N \Lambda \Sigma$  mesons  $\pi \rho \omega \eta K K$  elastic inelastic collisions among particles included using experimental data hadron hadron collisions ART model quite successful explaining many experimental observations including surprisingly large kaon antiflow heavy ion collisions AGS energies ART model also allows us understand whether strongly interacting matter formed collisions reaches chemical and or thermal equilibrium present study extend ART model include perturbatively  $E$  particle studies rare particles using transport model ',

'Though Letter constructed Born Infeld black holes presence cosmological constant discussed thermodynamical properties many issues however still remain investigated know Reissner Nordström AdS black holes undergo Hawking Page phase transition transition gets modified include Born Infeld corrections account hope carry detail study issue future Furthermore context brane world cosmology found brane moving Reissner Nordström AdS background generates non singular cosmology However shown brane always crosses inner horizon bulk geometry creating instability would interesting study cosmology brane moving charged black hole backgrounds constructed Note since charged holes inner horizon certain range parameters may generate non singular cosmology without creating instabilities mentioned ',

'prove uniqueness supersymmetric Salam Sezgin Minkowski  $S$  ground state among non singular solutions four dimensional Poincaré de Sitter anti de Sitter symmetry construct general solutions axial symmetry two dimensional internal space show included amongst family non singular away conical defect one pole distorted sphere solutions admit interpretation branes negative tension ',

'Longitudinal beam target single spin asymmetries center attention lately since measured HERMES CLAS experimental Collaborations measurements planned originally believed signals so called  $T$  odd fragmentation functions particular Collins function However types asymmetry receive contributions also  $T$  odd distribution functions fact often neglected analyses exhaustive treatment contributions  $T$  odd distribution functions carried completely far especially subleading order expansion  $Q\bar{Q}$  virtuality incident photon hard scale process including quark mass corrections purpose present work describe longitudinal beam target spin asymmetries complete way terms leading subleading twist distribution fragmentation functions consider single particle inclusive DIS  $e p e h X$  single jet inclusive DIS  $e p e$  jet  $X$  assume factorization holds processes even though present factorization proof observables containing subleading twist transverse momentum dependent functions recently proofs leading twist case presented Refs ',

'many possible applications mechanism Letter concentrated contribution leptogenesis baryogenesis calculation applicable phase fields rolling rolling phase start Hubble constant drops value comparable mass scalar fields time cosmological evolution CP violation efficient fields relaxed vacuum values CP violation mechanism turns plan discuss details particular applications concrete baryogenesis models future publication Note string cosmology brane world scenarios may provide natural settings origin scalar fields required mechanism e.g see Ref recent paper scalar fields brane world scenarios play new role spontaneous baryogenesis ',

'brane system appearing string D brane theory stableness important requirement find stable brane configurations SUSY bulk boundary theory systematically solve singular field equation using general mathematical result free wave solution  $S/Z$  space two scalars extra component bulk vector  $A$  bulk scalar  $\Phi$  constitute solutions different roles clarified importance parallel configuration disclosed boundary condition  $A$  boundary matter fields two important elements making localized configuration Among solutions solution  $c/c$  expected thin wall limit kink solution present bulk Higgs model corresponding non singular solution model expected give non singular stable brane solution SUSY bulk boundary theory ',

'spins parities  $\Theta/E$  yet known experimentally new wave pentaquark research theoretical papers take spin equal parity controversial chiral soliton Skyrme models parity positive constituent quark models usually positive present approach parity pentaquark given  $P/l/l$  angular momentum associated relative coordinates  $q$  subsystem analyze case subsystem four light quarks state orbital symmetry carries angular momentum  $l$  Although kinetic energy state higher totally symmetric state symmetry favourable flavour spin interaction colour spin interaction first case statement confirmed comparison realistic calculations positive parity negative parity based quark model Ref antiquark heavy  $c/b$  accordingly interaction light quarks heavy antiquark neglected consistent heavy quark limit Ref attractive spin spin interaction  $s$  light quarks incorporated shown stable narrow positive parity uudds pentaquark accommodated within model interaction form corresponds  $\eta$  meson exchange role lower energy whole system ',

'exist interesting cases deformation structure becomes simple One limit  $N$  superspace action reduce  $N$  super Yang Mills theory adjoint matter Another interesting case singlet deformation deformation parameters belongs singlet representation  $R$  symmetry group  $SU(R)$  Letter study  $N$  supersymmetric  $U$  gauge theory harmonic superspace singlet deformation case gauge supersymmetry transformations get correction linear deformation parameter Therefore easily perform field redefinition component fields transform canonically gauge transformation case  $N$  super Yang Mills theory field redefinition also possible case component fields transform canonically deformed supersymmetry transformation singlet case show field redefinition

nition redefined fields also transform canonically deformed supersymmetry construct deformed Lagrangian invariant gauge supersymmetry transformations find deformed Lagrangian characterized single function antiholomorphic scalar field ',

'consider finite time future sudden Big Rip type singularities may occur even strong energy condition violated equation state parameter time dependent Recently example singularity presented Barrow found another example Taking account back reaction conformal quantum fields near singularity shown explicitly quantum effects may delay make milder singularity argued evolution singularity realistic due quantum effects universe may end de Sitter phase scale factor blows picture generalized braneworld sudden singularity may occur brane qualitatively similar conclusions ',

'One great successes experimental program carried LEP put firm lower bound Higgs mass  $m_H$  GeV time together information coming SLD give strong indirect evidence Higgs boson still missing particle Standard Model SM relatively light high probability mass GeV search Higgs boson one main objective Tevatron future Large Hadron Collider LHC supposed span Higgs mass regions TeV hadron colliders main Higgs production mechanism gluon fusion process whose knowledge fundamental order put limits Higgs mass case Higgs discovered compare measured cross section SM result Concerning Higgs decay channels quite difficult hadron collider access part mass range favored LEP results so called intermediate Higgs mass region  $m_H$  GeV large QCD background dominant modes region rare decay  $H \rightarrow \gamma\gamma$  interesting alternative usual decay channels ',

'OPE VQCD r developed next paragraph review content paper relevant analysis Within framework short distance contributions contained potentials fact Wilson coefficients non perturbative contributions contained matrix elements organized multipole expansion  $r \rightarrow r/\Lambda_{QCD}$  following relation derived  $VQCD \rightarrow VS \rightarrow \delta EUS \rightarrow \delta EUS \rightarrow ig \rightarrow TFNC \rightarrow dte \rightarrow i\Delta V \rightarrow t \rightarrow E \rightarrow a \rightarrow \phi_{adj} \rightarrow t \rightarrow abr \rightarrow E \rightarrow b \rightarrow O \rightarrow VS \rightarrow r$  denotes singlet potential  $\delta EUS \rightarrow r$  denotes non perturbative contribution QCD potential starts  $\Lambda_{QCD} \rightarrow$  multipole expansion  $\Delta V \rightarrow VO \rightarrow VS \rightarrow r$  denotes difference octet singlet potentials see details Intuitively  $VS \rightarrow r$  corresponds  $VUV \rightarrow \mu f \rightarrow \delta EUS \rightarrow VIR \rightarrow \mu f$  adopt dimensional regularization analysis also refer hard cutoff schemes discussing conceptual aspects ',

'Recent publications employ variety methods calculating upper limits universally accepted procedure choose approach similar first advocated Feldman Cousins method since extended Conrad et al incorporate uncertainties detector sensitivity background estimate based approach described Cousins Highland refinement Conrad et al method Hill results appropriate behavior upper limit observed number events less estimated background case present measurement adopted method note Table contains numbers needed calculate upper limit using methods papers cited assume probability density functions  $F_{sens}$  background estimates Gaussian distributed ',

'frameworks however physical spacetime dimension input rather prediction theory fact standard theories whose gravitational sector described Einstein Hilbert action obstruction perform dimensional reductions spacetimes dimensions d question arises since eleven dimensional Minkowski space maximally super symmetric state theory well behaved around theory select configuration vacuum instead chooses particular compactified space less symmetry ideal situation instead would eleven dimensional theory dynamically predicted low energy regime could four dimensional effective theory scenario background solution effective spacetime dimension expected false vacuum propagators dynamical fields ill defined lest low energy effective theory could exist dimensions higher four ',

'presence chaotic motion nuclear systems firmly related statistics high lying energy levels Poisson distributions normalized spacings successive nuclear atomic excited levels spin parity correspond integrable classical dynamics Wigner's statistics signal chaotic motion corresponding classical regime Intermediate situations difficult assess recently proposal made treat spectral fluctuations  $\delta n$  discrete time series Defining  $\delta n \rightarrow E_n \rightarrow \rho \rightarrow E \rightarrow dE \rightarrow n \rightarrow \rho \rightarrow E$  mean level density allows mapping dimensionless levels unitary average level density analyzing energy fluctuations discrete time series found nuclear power spectra behave like noise postulating might characteristic signature generic quantum chaotic systems present work implement idea using f spectral behavior test presence chaos nuclear mass errors ',

'Table lists pairs B decays fact decay pairs since many particles final states observed either pseudoscalar P vector V mesons Note certain decays written terms VV final states others PP states three reasons First decays involve final state n However experimentally necessary find decay vertices final particles virtually impossible n always use  $\rho$  Second pairs decays related SU SM ss quark pair used However P s pure ss mesons  $\eta \rightarrow \eta \rightarrow ss$  component also significant uu dd pieces result b s b d decays really related SU SM final state involves  $\eta \rightarrow \eta$  therefore consider instead vector meson  $\phi$  essentially pure ss quark state Finally require B B able decay final state happen final state contains single K K meson However occur final state particle excited neutral kaon case one decay involves K K Assuming vector meson detected via decay  $\psi K s \pi$  measurement  $\sin \beta$  via  $B_d \rightarrow J/\psi K B \rightarrow B$  decay final state ',

'signals suggesting supersymmetry SUSY discovered LHC vital measure spins new particles demonstrate indeed predicted super partners method discussed spins SUSY particles determined Angular distributions sparticle decays lead charge asymmetry lepton jet invariant mass distributions size asymmetry proportional primary production asymmetry squarks anti squarks Monte Carlo simulations performed particular mSUGRA model point LHC resultant asymmetry distributions consistent spin slepton spin  $\chi$  consistent particles scalars ',

'noted BEBCNOMAD observed discrepancy experimental  $\rho$  rates estimated JETSET NOMAD proposed



herent 1 e phase direction light lasers called optical lasers radio masers Cosmic maser radio sources emitting lines molecules extremely high brightness temperature radiation Tb molecules methanol masers CH OH Tb value reach K masers hydroxyl molecules OH K typical size maser clusters neutron star radius order km Thus radiation dilution coefficient equal ed approximately therefore  $\mu B \hbar \nu$  hydrogen line cm order OH cm line order Eq ',

'exploring WKB limit quantum theory Bohm first notice although one starts ambiguities nature quantum system first order approximation fits ordinary classical ontology mean real part Schrödinger equation polar decomposition wave function becomes classical Hamilton Jacobi equation limit terms involving  $\hbar$  neglected contrast approach Letter show classical trajectories arise short time quantum propagator terms  $\Delta t$  neglected fact actually already observed Holland twenty years ago page book infinitesimal time intervals considered whose sequence constructs finite path shown along segment motion classical negligible quantum potential follows quantum path may decomposed sequence segments along classical action minimum novel contribution present Letter improved proof Holland's result using improved version propagator due Makri Miller See also de Gosson discussion ',

'goal glued trees GT algorithm quantum search following beginning left most vertex given GT graph traverse graph reach right most vertex referred target vertex Childs et al use a lgorithm show quantum walk search fundamentally effective classical random walk search presenting class graphs GT graphs force classical random walks make exponentially many queries oracle encoding structure graph traversable quantum walks polynomial number queries oracle order study robustness algorithm detrimental effects decoherence shall determine effectively achieves goal subjected increasing degree phase damping noise reason focus probability walker target vertex end walk thus consider GT graphs one illustrated Fig b i e c consisting n layers gluing stage thus labelled  $G_n$  ',

'Another remarkable feature quantum field treatment revealed investigation vacuum state classical field vacuum realized simply setting potential zero resulting unaltered free evolution particle s plane wave  $\Psi_I$   $\Psi_{III}$  k quantized treatment vacuum represented initial Fock state n still interacts particle yields final state  $\Psi_{III}$  behind field region  $\Psi_I$  k  $\Psi_{III}$  n t n k n n photon exchange probability  $P_{n \rightarrow n} = \Lambda \Lambda_n$  particle thus transfers energy vacuum field leading Poissonian distributed final photon number Let s consider example superconducting resonant circuit source field magnetic field along axis properly shaped coil well approximated rectangular form particle magnetic dipole moment passing coil interacts circuit excites measurable loss kinetic energy even circuit initially uncharged classically field couple phenomenon vacuum quantum field theory mean influence known Casimir forces Lamb shift clearly visible well ',

'systems Stern Gerlach force prominent high electromagnetic field gradient Section considers implications coupling spin classical electron rapidly varying electromagnetic field produced laser driven plasma wave Sufficiently short high intensity laser pulses form longitudinal waves within electron density plasma density waves propagate speed comparable group speed laser pulse plasma electrons form wave however electrons caught wave accelerated high fields wave eventually collapses electrons damp wave wave breaks extremely high electric field gradient plasma wave near wavebreaking provides excellent theoretical testing ground effects Stern Gerlach type contributions trajectory test electron ',

'Flow induced deformations lead irreversible changes structure polymeric fluid rate extension far exceeds rate relaxation polymer chain broken Mechanical degradation polymers extensional flow long recognised leads reduction average molecular weight A Alamry et al recently reported evidence flow induced polymer degradation DoD jetting Central scission observed polystyrene number good solvents certain jetting conditions bounded range molecular weights Since molecules fully extended fractured centre polymer chain paper investigate whether flow induced central scission possible conditions DoD jetting ',

'conclusion consequence high jet speeds small nozzle diameters combination relatively high viscosity solvent modest molecular weights polystyrene results high Weissenberg number s moderate values extensibility L studied discussed earlier papers jetting fluid combinations de Gans et al lie different jetting regime full extension occur relaxation time controls viscoelastic behaviour Consequently inkjet fluid assessment methods need provide full characterisation including linear nonlinear viscoelastic properties complexity suggests assessments inkjet fluids might include jetting sets DoD print head devices different sensitivities various parameters rather reliance testing without jetting expected outcome present work echo pragmatic viewpoint expressed map misery Clasen et al may provide way forward future R strategies towards ink testing ',

'Denier Hewitt shown bounded solutions a b c subject a b exist shear thinning case n shear thickening case shown solutions become non differentiable critical location  $\eta_c$  although h transpires singularity regularised entirely within context power law model consider flows Thus study consider flows power law index range n also shown n ensure correct algebraic decay numerical solutions one must apply Robin condition  $u \sim v \eta^n$  n  $u \sim v \eta^n$  suitably large value  $\eta$   $\eta$  Newtonian case relationship becomes singular due fact n functions  $u \sim v$  decay exponentially Cochran showed case  $u \sim v \eta^w$   $u \sim v \eta^w$   $u \sim v \eta^w$   $u \sim v \eta^w$  ',

'order DLS based micro rheology successful must sufficient scattering contrast sample tracer particles order achieve maximum possible concentration tracer particles added single scattering events still dominated determined measurements diffusion coefficients water different concentrations order determine whether background scattering sample sufficiently low compared tracer particles also compared scattering intensities obtained samples witho



ut tracer particles function time results exercise shown Fig figure seen although initially scattering sample without tracer particles low compared containing tracer particles gelation proceeds eventually ceases case presumably development supra molecular structures seen previously Fig B Based results Fig decided use data collected first min experiment point scattering gel network became rather large ignore ',

'Tack important property PSA quantifies ability form instantly bond brought contact surface final adhesion cohesive strength bond influenced numerous factors including surface energies adhesive substrate dwell time contact pressure mechanical properties adhesive well environmental conditions temperature humidity Therefore tack important many applications instant bond required however equally important clean separation initially bonded surfaces desirable Many different methods measuring tack devised four main ones rolling ball loop tack quick stick probe tack tests advantages disadvantages specific testing method selected based particular application ',

'first systems biopolymer gel involves thermoreversible gelation aqueous gelatin solutions form physical gel whereas systems considered herein involve formation chemical gels featuring permanent cross linked branching networks second system commercial silicone dielectric gel SDG used production electronic products created industrial printing processes third experimental system fibrin gel formed thrombin induced polymerisation fibrinogen molecules gel network product latter case forms principal microstructural component blood clot latter case particularly interesting critical gel established GP serves template ensuing development microstructure associated rheological properties post GP phase fibrin clot evolution ',

'convenient widely reported technique detection GP involves measurements complex shear modulus  $G$  range frequencies  $\omega$  oscillatory shear GP elastic viscous components complex modulus  $G^*$   $G'$  respectively scale oscillatory frequency  $\omega$   $G' \propto \omega$   $G'' \propto \omega^\alpha$  termed stress relaxation exponent Thus GP may identified instant  $G'$  scale frequency according identical power laws behaviour corresponding attainment frequency independent phase angle  $\delta$   $\tan \delta$  GP measurements may involve frequency sweeps repeated consecutive application set small amplitude oscillatory shear SAOS waveforms Fourier Transform Mechanical Spectroscopy FTMS  $G'$  found simultaneous application several harmonic frequencies composite waveform subsequent Fourier analysis Frequency sweeps limited relatively slow gelation processes due sample mutation interpolation errors FTMS may overcome limitations unsuitable markedly strain sensitive materials fibrin gels due strain amplitude composite waveform exceeding linear viscoelastic range LVR ',

'Equilibrium surface tension measured C SITA probe line bubble tensiometer Rheological measurements performed ARES rheometer shear rates piezo axial vibrator PAV frequencies kHz Table shows measured values viscosity real component  $\eta'$  complex viscosity  $\eta^*$  surface tension solutions without surfactant mixture concentrated wt solution viscosity fell mPa.s low shear rate mPa.s highest shear rates PEDOT PSS fluids also exhibited elasticity steadily reduced increasing frequency aqueous PEDOT PSS solutions shear thinned significantly presence surfactants affect trends rheological behaviour particularly higher frequencies s ',

'paper propose general agent based distributed framework agent implementing different metaheuristic local search combination Moreover agent continuously adapts search process using direct cooperation protocol based reinforcement learning pattern matching Good patterns make improving solutions identified shared agents agent based system aims provide modular flexible framework deal variety different problem domains evaluated performance approach using proposed framework embodies set well known metaheuristics different configurations agents two problem domains Permutation Flow shop Scheduling Capacitated Vehicle Routing results show success approach yielding three new best known results Capacitated Vehicle Routing benchmarks tested whilst results Permutation Flow shop Scheduling commensurate best known values benchmarks tested ',

'mentioned earlier paper represents ongoing efforts efficiently address stochastic MPSP Future work may consider investigating whether algorithm would successful solving variant s MPSP include operational constraints variable cut off grade grade blending stockpiling solving classical variant considered paper Indeed general purpose algorithm applicable variants research avenues include considering strategies updating penalties within PH methods solving sub problems Finally another important research direction development efficient solution approaches Since observed empirically problem formulation often achieves small integrality gaps one approach could solve linear relaxation problem using efficient algorithm use LP rounding procedure get integer solution ',

'propose equilibrium model allows analyze long run impact electricity market design transmission line expansion regulator investment generation capacity private firms liberalized electricity markets model incorporates investment decisions transmission system operator private firms expectation energy only market cost based redispatch different specifications consider cases one vs multiple price zones market splitting analyze different approaches recover network cost in particular lump sum generation capacity based energy based fees order compare outcomes multilevel market model first best benchmark also solve corresponding integrated planner problem Using two test networks illustrate energy only markets lead suboptimal locational decisions generation capacity thus imply excessive network expansion Market splitting heals problems partially results valid considered types network tariffs although investment slightly differs across regimes ',

'Regarding implications results paper note two points practical point view endowed weighted additive model distance function structure takes negative values points located outside technology non negative values points production possibility set respect weighted additive distance function methodologically supports branch literature resorts weighted additive model related approach measure productivity time see example Mahlberg Sahoo Chang et al theoretical point view provided new distance function interesting properties contrast usual ones mainly technical inefficiency estimated weighted additive distance function coincides weighted additive model means technical inefficiency measured following Pareto Koopmans notion efficiency productivity determined decomposed time weighted additive distance function emerges attractive tool used cross period evaluation returns scale changes since distance function always feasible even Variable Returns Scale ',

'Iron ore may extracted blocks meter located three consecutive mining benches meter height case study ten equally probable scenarios iron content phosphorous silica aluminum LOI used quantify joint uncertainty characteristics iron ore deposit considered input SSTPS formulation proposed previous section simulated scenarios available provided generated using stochastic simulated technique detailed Boucher Dimitrakopoulos area considered bounded limits given volume production long term first year production schedule provided Fig shows scenarios iron ore content well corresponding conventional single estimated average representation iron content Fe O upper bench total blocks tonnes Fe O P SiO Al O LOI available ',

'Two state models often insufficient fit complex traces therefore also study approximate fitting large MPPs single class setting known limitation MMPPs inability simultaneously fit many statistical descriptors due non linearity underlying equations Bodrog Heindl Horváth Telek Heindl Horváth Gross Horváth Telek led definition several approaches fit complex traces composing multiple small sized MMPPs MAPs using Kronecker operators Andersen Nielsen Casale Zhang Smirni Horváth Telek methods employ composition operators moment fitting offering different trade off computational cost fitting accuracy compared fitting methods based EM algorithm Breuer Horváth Okamura Klemm Lindemann Lohmann particular superposition operator allows one describe trace statistical multiplexing several MMPPs expense exponential growth number states resulting process Sriram Whitt state space explosion obstacle application MMPPs MAPs modeling real systems example considerably slows even renders infeasible numerical evaluation queueing models matrix geometric methods Bini Meini Steffé Pérez Houdt Pérez Velthoven Houdt ',

'Statistical Associating Fluid Theory SAFT well developed perturbation theory used describe quantitatively volumetric properties fluids reader referred several reviews topic describe various stages development multiple versions available fundamental difference versions underlying intermolecular potential employed describe unbounded constituent particles Hard spheres square well fluids LJ fluids argon alkanes employed reference fluids different incarnations SAFT purpose work center particular version SAFT EoS is e SAFT VR Mie recently proposed Laffitte et al expanded group contribution approach SAFT  $\gamma$  Papaioannou et al particular version SAFT provides closed form EoS describes macroscopical properties Mie potential also known n potential generalized form LJ potential albeit predating decades Mie potential form  $\phi(r) = \frac{C}{r^{12}} - \frac{\epsilon}{r^6}$  where C analytical function repulsive attractive exponents  $\lambda_a$   $\lambda_r$  respectively  $\sigma$  parameter defines length scale loosely related average diameter Mie bead  $\epsilon$  defines energy scale corresponds minimum potential energy two isolated beads expressed ratio Boltzmann constant  $k_B$  Mie function written deceptively suggests four parameters needed characterize behaviour isotropic molecule however exponents  $\lambda_a$   $\lambda_r$  intimately related fluid phase equilibria one needs consider independent parameters Accordingly choose herein fix attractive exponent  $\lambda_a$  would expected representative dispersion scaling simple fluids refer repulsive parameter  $\lambda_r$  potential simplifies  $\phi(r) = \frac{\lambda}{r^{12}} - \frac{\epsilon}{r^6}$  ',

'Next phase current study use parameters obtained pure component systems transferable manner represent corresponding mixtures Mixtures n alkanes H<sub>2</sub>O studied previously SAFT  $\gamma$  SW general well known extreme nature phase separation makes challenging model mixtures H<sub>2</sub>O non polar compounds large differences dielectric constant two phases well dipole moment H<sub>2</sub>O hydrophobic molecules especially difficult obtain phase independent unlike interaction parameters thus model simultaneously equilibrium phases previous work emphasis placed obtaining accurate description alkane rich phases liquid vapour small absolute relative deviations aqueous phase composition achieved systems interest current work typically aqueous mixtures containing high proportion H<sub>2</sub>O alkylamine CO Consequently order provide improved overall description fluid phase equilibria conditions interest refinements made unlike parameters presented previous study relating interactions H<sub>2</sub>O alkyl groups CH<sub>3</sub> CH<sub>2</sub> namely  $\epsilon_{CH_3}$   $\epsilon_{CH_2}$   $\epsilon_{CH}$   $\epsilon_{H_2O}$   $\lambda_{CH_3}$   $\lambda_{CH_2}$   $\lambda_{CH}$   $\lambda_{H_2O}$  ',

'Recently fundamental thermophysical property research ionic clathrate hydrates experienced remarkable growth particularly last ten years Previously beginning first paper unusual hydrates tetrabutylammonium salts number studies could found ionic clathrate hydrates hereafter semiclathrate hydrates unified terminology semiclathrate hydrate generally accepted Semiclathrate hydrates attracting increased attention promising applications phase change materials refrigeration systems gas capture storage addition interesting speculation semiclathrate hydrate may regarded representative substance study thermal conductivity clathrate hydrate general reduce characterization problems solid sample since semiclathrate hydrate formed around ambient temperature atmospheric pressure easy handle accurately measuring thermal conductivity semiclathrate hydrates many similarities clathrate hydrates m

may make possible deeper understanding unique anomalous behavior thermal conductivity clathrate hydrates currently experimental studies thermal conductivity semiclathrate hydrates',

'Substrate Induced Coagulation SIC coating process provides self assembled almost binder free coating small particles research far used coat variety surfaces highly conductive carbon blacks Layers deposited technique used electromagnetic wave shielding metallization process through holes printed wiring boards manufacture conducting polymers Teflon advantage dip coating process used kind surface provided substrate stable water particles used coating form meta stable dispersion Recently non aqueous SIC coating process carbon black developed investigating stabilities non aqueous dispersions dispersions used prepare LiCoO<sub>2</sub> composite electrodes Li ion batteries improved conductivity keeping content active battery material high',

'development performance based design studies conducted fire risk analysis buildings different perspectives levels Models FIRECAM FIERASystem used calculate expected life risk studies probabilistic methods used assess levels people safety buildings Quantitative risk analysis approaches also used quantify risk occupants using stochastic factors However studies date largely concerned various aspects fire risk analysis little way development systematic theoretical methods analyzing fire risk buildings terms fire risk management Existing fire risk management involves identification alternative fire safety design options ongoing inspection maintenance fire protection systems evacuation training drills study basic process fire risk analysis building described fire risk analysis model based scenario clusters established consideration characteristics fire dynamics occupants behavior number deaths directive property loss selected fire risk indices average fire risk residential buildings quantitatively analyzed appropriate fire risk management measures adopted',

'mentioned difficulties associated calibration process inspired concept inverse modelling case experimental data become entirely integrated calibration process optimization routine used quantify best set parameters explain observed pyrolysis behaviour i.e. multivariable curve fitting used experimental data model calibration mass loss rate surface temperature optimization technique used function number variables interactions past uncertain parameters i.e. kinetics parameters generally used potentiometers However sophisticated mathematical procedures developed increase number parameters optimized simultaneously e.g. Genetic Algorithm GA Shuffled Complex Evolution SCE Lautenberger Fernandez Pello recently investigated influence choice algorithm optimized parameters generated using code GPYRO set synthetic data mass loss rate surfaces temperature tried different algorithms find back set input parameters four optimization algorithms provided results absolute average error SCE suitable algorithm use synthetic data conveniently avoids problem agreement actual physical phenomena modelling assumption',

'RemarkThe purely radiative spacetimes used reference solutions analysis perturbations Minkowski spacetime way seeing consider Newman Penrose constants spacetime Newman Penrose constants set absolutely conserved quantities defined integrals certain components Weyl tensor Maxwell fields cuts null infinity see Einstein Maxwell case shown value Newman Penrose constants vacuum radiative spacetime coincides value rescaled Weyl spinor i this result extended electrovacuum case using methods article radiative spacetimes arising construction seen value Weyl spinor i essentially mass quadrupole seed static spacetime follows Newman Penrose constants radiative spacetime take arbitrary values hand Minkowski spacetime Newman Penrose constants exactly zero perturbations thereof small Thus precise sense radiative spacetimes generically perturbations Minkowski spacetime unless Newman Penrose constants vanish',

'calculate hedonic price indices linear model initial reference price calculated Triplet t present study adopts approach de Haan Diewert price index constructed using price generated estimated coefficients base period regression model calculated based based period average values given cell phone plan characteristic z operator Supplementary Table S continuous characteristics direct averages used binary characteristics proportions cell phone plans containing feature used resulting prices average cell phone plan converted index applying previously calculated pure price changes  $\delta s$  Finally overall hedonic price index calculated weighted average firm level indices Weights correspond relative proportion cell phone plans operator sample HT Vip Tele',

'Social network gaming refers playing games connected social networking services SNS directly mobile applications apps popular online activity Social network games SNG generally free to play award monetary prizes users make in game purchases advance within game customize game give gifts friends access exclusive benefits features leading games referred freemium Although SNG connected SNS encourage users interact connections SNG played without social interaction SNG grown rapidly popularity global SNG market predicted grow annually reach total market value US billion Transparency Market Research survey Facebook users Australia November reported million social gamers across Australia almost play SNG daily Spiral Media highly likely use SNG increased since time',

'However measured reflectivity less predicted value likely relate amongst factors roughness GaN AlN interfaces particularly first layer DBR stack non uniformity DBR layer thicknesses Using STEM measurements thickness layer a plane thickness stack calculate new model green curve overall reflectivity reduced implies variations layer thickness stack main source reduced reflectivity comparison model fact closer look cross sectional STEM data careful extraction layer thickness revealed whilst layer thicknesses fairly consistent DBR s

tack wing regions monotonic variation measured layer thicknesses window regions GAN layer width smoothly increases AlN layer thickness decreases DBR stack observation could potentially practical importance samples grown templates uniform defect density one could achieve much better reflectivities simply altering growth time counteract change growth rate possibility subject ongoing investigations addition presence cracks trenches top surface may also reduce measured reflectivity ',

'Note presented architecture works frame level meaning single frame plus corresponding context fed forward network obtaining class posterior probability target languages fact makes DNNs particularly suitable real time applications unlike approaches i.e. i vectors potentially make decision language new frame Indeed frame combine evidence past frames get single similarity score test utterance target languages simple way combination assume frames independent multiply posterior estimates last layer score  $s_l$  language  $l$  given test utterance computed multiplying output probabilities  $p_l$  obtained frames equivalently accumulating logs  $s_l - N \log p_l$   $x_t$   $\theta$  represents class probability output language  $l$  corresponding input example time  $x_t$  using DNN defined parameters  $\theta$  ',

'final set experiments involved adaptive retraining GMM HMM parameters following aNAT procedure new model provided improvement similar using aCMLLR transforms baseline GMM HMM model However training show based aCMLLR transforms top adaptively trained model boosted improvement absolute showed adaptive training provided better flexibility model adapt specific background conditions existing show Finally factorisation approach using MLLR speaker transforms top aNAT model show based aCMLLR transforms tested increased improvement absolute relative reflects difficulty performing accurate speaker clustering task actually hampers speaker adaptation ',

'paper proposes sentence stress feedback system sentence stress prediction detection feedback provision models combined system provides non native learners feedback sentence stress errors improve English rhythm fluency self study setting sentence stress feedback system devised predict detect sentence stress practice sentence accuracy prediction detection models respectively stress feedback provision model offers positive negative stress feedback spoken word comparing probability predicted stress pattern detected stress pattern experiment evaluated educational effect proposed system incorporated CALL system significant improvements accentedness rhythm seen students trained system control group ',

'research work paper elaborates theoretical effectiveness proposed method based multivariate EMD also clearly indicates numerical simulations applications bearing monitoring expansion standard EMD multivariate EMD successful exploration Using multiple sensors collect signal different locations machine using multivariate EMD analyze multivariate signal contribute comprehensively collect frequency components related bearing fault beneficial extract fault information especially early weak fault characteristics characteristic frequencies simulated signal fault frequencies practical rolling bearing signal extracted order IMF groups thus showing multivariate EMD effective signal decomposition algorithm competently applied fault diagnosis rolling bearings combined multiscale reduction method fault correlation factor analysis signal acquisition processing given circumstance trend toward use multiple sensors multivariate EMD appears useful meaningful kind multivariate data processing algorithm analyzing simulated signal two different practical multivariate signals results demonstrate significance proposed method field fault diagnosis rolling bearing ',

'GFRFs nonlinear systems determined either parametric model based method nonparametric model based method parametric approach nonlinear parametric model first identified input output data GFRFs obtained mapping resultant model frequency domain using probing method nonparametric approach often referred frequency domain Volterra system identification based observation Volterra model nonlinear systems linear terms unknown Volterra kernels frequency domain corresponds linear relation output frequency response linear quadratic higher order GFRFs linear relationship allows use least squares LS approach solve GFRFs Several researchers used method estimate GFRFs usually made assumption known priori system study represented two three terms However information rarely available priori ',

'However useful depiction apposite well supported statistical model prepared allow process driven CRG MAP model discovered indeed generating idle process identifying disconnected components system allows us immediately make assertions impact various controls might apply regulatory process believe model causal extension BN context microarrays objective clustering identify patterns among data decide genes focus gene specific experiments therefore necessary scientist make causal conjectures effect controls available expressions reflecting underlying regulatory process studies conjectures universal nuanced evoking ideas parsimony ',

'first step PB enumeration conditional sample space abductive logic programming could compared logical inference ProbLog languages aim generate propositional formula compile decision diagram logical inference PB based abductive logic programming ProbLog grounds relevant parts probabilistic program Moreover PB compilation boolean formulas performed using RO BDDs ProbLog use wider range decision diagrams e.g. sentential decision diagrams SDD deterministic decomposable negation normal form d DNNF differences reflect different aims two PPLs ProbLog focuses models logical inference needs efficient resulting representation decision diagrams need compact PB focuses models logical inference typically easy however must applied repeatedly according nature number observations However future work PB could benefit use compact decision diagrams ',

'case PSR applied vessels preservation high curvature branches concavities demands high value parameter resulting models high number polygons cope problem Wu et al evaluates variant PSR work referred scale adaptive SA includes curvature dependent polygonization e.g. increasing decreasing size triangles according local curvature Wu et al Wu et al methods including MC without smoothing decimation evaluated application vessel modeling authors point SA suitable method reconstruction vessels applications surgery planning methods evaluated Wu et al could also compared another set techniques known model based methods Preim Oeltze widely used context vessel modeling surgery planning ',

'Plastically deformed MGs develop inhomogeneity show harder softer regions could principle associated according composite model MG provides basis dislocation based theory search plastic flow hindered softening MGs associated shear banding contrast work hardening familiar conventional alloys Anelastic deformation however interest time dependence must relate relaxation processes MG structure turn connected onset plasticity particular anelasticity may offer way study operation shear transformation zones STZs often used interpret deformation MGs Fujita et al used torsion tests observe anelasticity MGs loaded maximum cylindrical sample surface shear yield stress  $\tau_y$  present work apply torsion MG samples reach stresses  $\tau_y$  first time elastic regime investigate effects torque reversal ',

'SPS utilized several studies retain nanostructure aluminum alloy powders consolidation Ye et al investigated effect processing cryomilled Al powder via SPS X ray Diffraction XRD grain size calculations SPS showed average grain size alloy increased nm nm powder bulk state Subsequently hardness values obtained nanoindentation specimens AA produced via SPS highly improved comparison conventional sintering methods grain coarsening takes place larger scale another study combination cryomilling SPS AA B C nanocomposites powder found largely improve microhardness flexural strengths bulk nanocomposite Rana et al investigated effect SPS mechanically milled AA Al Mg Si micro alloy powder average grain size h mill ing nm increased nm processing SPS C Microhardness compressive tests carried consolidated near full density specimens unmilled milled powders results showed significant increase hardness compressive strengths milled nanocrystalline powders result fine grain size ',

'need power generation industry improve thermal efficiency power plant led development C r martensitic steels development research P steels started since late s early s respectively work focussed creep strengths due intended application high temperature Recently introduction cyclic operation power plant introduced possibility fatigue problems Bore cracking due effects varying steam warming reported temperature cycling causes thermal gradients inside outside components cause cyclic stress levels concerns Recently research thermal mechanical analysis P carried including characterisation cyclic behaviour material using two layer unified visco plasticity models ',

'previous publications present authors proposed method incorporate thermodynamics ternary alloys liquid diffusion governed solidification kinetics multiphase volume average solidification model Back diffusion disregarded way access thermodynamic data e.g. Thermo Calc tabulation interpolation program ISAT Situ Adaptive Tabulation suggested ISAT approach possible perform online call thermodynamic data trace formation individual solid phase primary peritectic eutectic etc number calls thermodynamic data equal product number discretized volume elements time steps calculation iterations per time step calculation becomes exhausting Therefore current model modification previous model using linearized phase diagram online call thermodynamic data necessary addition model presented paper extended consider back diffusion solid modifications model used perform casting process simulations incorporated full diffusion governed solidification kinetics ternary alloys reasonable computation cost ',

'Due complex nature thermal spray process modelling playing key role providing key insights process design operations relationships among processing conditions particle characteristics resulting coating properties nonlinear might difficult unravelled experimental studies alone e.g. Detailed information atomic level changes leading changes observed macroscale appropriately obtained MD simulation effect temperature velocity determined precisely work relatively simpler spray system copper copper particle simulated obtain better understanding particle recrystallization solidification deformation mechanics topography impacting particles Using state of the art methods examine physical mechanisms involved impacting behavior structure property relationship suggested consecutive layer deposition particles better understood understanding individual particle impacts particle surface interaction mechanism relation Reynolds number offer information quality coating response shock heating general practice engineering components thermally sprayed continuous multilayer mode cooling therefore opportunity developing richer theoretical models single multiple particle impact conjunction actual spraying tests identify cohesive adhesive strength hardness residual stresses ',

'principle high throughput materials science one know priori value data lies specific application Trends insights deduced posteriori requires efficient interfaces interrogate available data various levels developed simple WEB based API greatly improve accessibility utility AFLOWLIB database scientific community client access calculated physical properties thermodynamic crystallographic mechanical properties well simulation provenance runtime properties included systems data may used directly e.g. browse class materials desired property integrated higher level work flows interface also allows sharing updates data used previous published works e.g. previously calculated alloy phase diagrams thus database expanded systematically ',

'Discrete Element Method applied spheres well established reasonably realistic tool wide range engineering disciplines modelling packing flow granular materials Asmar et al describes fundamentals method applied code developed in house Nottingham since widely documented details reproduced simply summary applies explicit time stepping approach numerically integrate translational rotational motion particle resulting forces moments acting timestep inter particle particle wall contacts modelled using linear spring dashpot slider analogy Contact forces modelled normal tangential directions respect line connecting particles centres Particle elastic stiffness set sphere overlap significant moderate contact damping applied Particle cohesion also modelled assumed negligible current study translational rotational motion particle modelled using half step leap frog Verlet numerical integration scheme update particle positions velocities Near neighbour lists used increase computational efficiency determining particle contacts zoning method used time list composed system divided cubic regions particle centre within one zone potential contacting particles within next door neighbour zones Full details given Asmar et al ',

'Structural adhesives increasingly used bonding components within critical load bearing engineering structures aerospace automobiles Typically adhesives based epoxy polymers Epoxies inherently brittle due homogeneous microstructure highly cross linked nature Thus much research focused improving fracture toughness epoxy polymers incorporating second minority phase nano scale modifiers fall one two main categories inorganic additives e.g silica glass alumina nano clays carbon nanotubes organic usually rubber particles Rubbery additives either core shell rubber particles form curing via reaction induced phase separation on mechanisms primary energy dissipation mechanisms rubber toughened epoxies known plastic void growth shear band development also shown combination additives create hybrid material provide synergistic toughening effects e.g carbon nanotubes silica nanoparticles rubber silica nanoparticles ',

'paper crystal plasticity model combination XFEM applied study cyclic deformation fatigue crack growth nickel based superalloy LSHR Low Solvus High Refractory high temperature first objective research develop evaluate RVE based finite element model incorporation realistic material microstructure second objective work determine parameters crystal plasticity constitutive model describe cyclic deformation behaviour material using user defined material subroutine UMAT interfaced finite element package ABAQUS model parameters calibrated extensive finite element analyses fit monotonic stress relaxation cyclic test data third objective predict crack growth combining XFEM technique calibrated crystal plasticity UMAT accumulated plastic strain used fracture criterion ',

'results demonstrate SW SVR predicts complicated micrometeorological data best prediction n performance lowest computational complexity compared standard algorithms particular found dynamic aggregation models built little extracted data D SDC effective compatibility high prediction performance low computational complexity However problems solved SW SVR Firstly prediction performance SW SVR sometimes deteriorates despite increase training data particular problem occurred conditions prediction horizons h shown Fig data extracted D SDC involves unnecessary training data highly accurate prediction D SDC extracts data extracted data training periods shorter prediction performance SW SVR never deteriorates due increase training data Therefore must review feature mapping algorithms D SDC avoid extracting unnecessary training data Meanwhile SW SVR based combination several algorithms kernel approximation PLS regression k means D SDC linear SVR Moreover algorithm several parameters Therefore SW SVR varied parameters takes time tune parameters experiment used grid search roughly decide parameters certain time However still room improvement prediction performance using approaches genetic algorithm instead grid search Huang Wang ',

' More efforts directed towards advancing methods feature extraction overcome influence dynamic factors limit performance use advanced machine learning methods deep neural networks muscles synergies extraction also investigated problems influence multiple dynamic factors methods may provide substantial improvements upon utilized time and frequency EMG feature extraction methods Diener Janke Schultz Ison Vujaklija Whitsell Farina Artemiadis Park Lee Meanwhile showed performance learning algorithms improved using feature extraction methods rely angular information muscle activation patterns Features TD PSD DFT proved successful others reducing impact two dynamic factors considered paper features readily implemented prosthesis controller real time control especially EMG pattern recognition systems nowadays becoming available clinical testing e.g COAPT complete control system Kuiken et al <https://www.coaptengineering.com> ',

'recent years mainly motivated impulse data mining many methods dimensionality reduction arisen Within worth highlighting Principal Component Analysis method PCA Jolliffe N dimensional vector space simplest version PCA linear PCA technique finds mutually uncorrelated vectors onto projection samples generates highest variances result set orthogonal vectors sorted descending order achieved variance first vectors onto variance projection samples maximum sense original KPIs constitute N dimensional vector space basis whereas N synthetic KPIs represent orthogonal vectors highest variance rigorous N synthetic orthogonal KPIs may be computed However small set first N enough account variance data ',

'paper highlighted band frequencies outside conventional operation range close electrical resonance eddy current probe magnitude impedance SNR reaches peak SNR scans three slots varying depth enhanced factor SNR measured MHz result defect decoupling resonance shift effect referred near electrical resonance signal enhancement NERSE phenomenon NERSE frequency operation significant potential ECT inspection opens range investigative possibilities

s Within investigation magnitude electrical impedance analyzed immediate extension investigation consider phase information determine whether similar exploitable NERSE effect exists ',

'EM sensors exploit difference magnetic properties relative permeability electrical conductivity samples different microstructural phase balances ferromagnetic steels change relative permeability significant effect Previously multi frequency EM sensors shown able measure austenite ferrite fraction model HIPped austenitic ferritic stainless steel powder alloys large difference magnetic properties ferrite ferromagnetic austenite paramagnetic phases makes change signal large hence relatively easy measure EM sensors also measured levels decarburisation variation ferrite content depth steel rod approach adopted relate overall steel EM sensor signal microstructure construct finite element FE model microstructure phase region size distribution EM properties individual phases assigned regions give overall EM properties steel Within model particular sensor geometry included e.g. two dimensional axisymmetric cylindrical sample tubular sensor interaction steel external circuit s predicted way different microstructures sensor designs compared ',

'number avenues explore future work particular use time frequency analysis methods STFT spectrogram utilised simplest implement Whilst echoes could clearly resolved time frequency spectrogram suffers fixed resolution i.e. increase time resolution necessarily leads decrease frequency resolution methods time frequency analysis discrete wavelet analysis benefit advantage multi resolution analysis offers improved temporal resolution high frequency components frequency resolution low frequency components Also whilst current work utilised SH waves generated EMATs physics describes pulsed array system universal types waves Future work include demonstrating phenomenon number systems example using longitudinal ultrasonic waves electromagnetic waves ',

'Global optimisation algorithms used study solve optimisation problem known efficient in incorporating statistical information dealing complicated objective functions multiple local minima maxima genetic algorithm GA global optimisation technique mimics biological evolution processes used particular study algorithm starts random selection population decision variable domain X genetic algorithm repeatedly modifies population step algorithm selects group individual values population parent evolved crossover mutation produce members next generation process repeated several generations optimum solution reached See fuller description GA ',

'Total Focusing Method TFM beam synthetically focused every point target region follows obtaining FMC data target region x z plane D Fig discretized grid signals elements array summed synthesize focus every point grid Linear interpolation time domain signals necessary since discretely sampled intensity TFM image ITFM point x z given ITFM x z  $HTR_c \times T \times z \times R \times z$  forall  $T$  Where  $HTR$  Hilbert transform signal  $uTR$  FMC data  $xT \times$  position transmitting element  $xR \times$  position receiving element  $R$  Note  $z$  position elements zero Fig a summation carried possible transmitter receiver pairs therefore uses information captured FMC algorithm referred conventional TFM paper ',

'known temperature sample rises Lorentz mechanism remains dominant  $T_c$  steel reached  $C_{low}$  carbon steel magnetostrictive mechanism becomes efficient Previously thought due thin ferromagnetic oxide layer sample surface surface cooler bulk material layer concentrates magnetic field increasing generation efficiency Recent studies also show rearrangement magnetic moments ordered domains disordered state magnetic phase transition lowers magnetostriictive constant ferromagnetic paramagnetic transition accompanied large changes efficiency electromagnetic ultrasound generation leading use EMATs method studying phase transitions magnetic alloys ',

'Shear horizontal SH ultrasound waves guided waves propagation properties affected geometry propagation medium symmetric anti symmetric modes phase group speeds dependent frequency sample thickness bulk shear wave speed properties different modes useful thickness measurement case complication SH thickness independent speed equal shear wave speed non dispersive phase group speed equal shear wave speed frequencies oscillation direction SH ultrasound plane surface wave generated perpendicular propagation direction shown Fig respect reference interface typically sample surface certain conditions short propagation distances SH waves treated bulk waves ',

'Volume EM performed using transmission scanning electron microscopes approach strengths weaknesses choice dependant required lateral x axial z resolution size structure interest Historically transmission electron microscopy TEM tool choice ultrastructural examination biomedical specimens sub nanometer resolution However many cell biology studies structural resolution actually limited deposition heavy metals onto membranes sample preparation addition voxel dimensions may need half smallest expected feature interest Briggman Bock Advances scanning electron microscopy SEM technology driving paradigm shift electron imaging SEMs field emission electron sources high efficiency electron detectors achieve lateral resolutions order nm allowing visualisation structures synaptic vesicles membranes De Winter et al Knott et al Vihinen et al Villinger et al though resolving individual leaflets membrane bilayers remains challenge Vihinen et al use low beam energies also limits interaction volume enhancing axial resolution Hennig Denk review volume imaging transmission scanning EMs explored moving traditional manual techniques latest systems aspects sample preparation imaging automated ',

'Many applications fluid mechanics shown surface suction used effective flow control mechanism example Gregory Walker discuss introduction suction extends laminar flow region sw

ept wing reducing thickness boundary layer magnitude crossflow velocity conclusions swept wing flow arose equivalent studies von Kármán rotating disk flow see Gregory Walker Stuart work since continued related flows using numerical asymptotic approaches see Ockendon Dhanak Bassom Seddougui Lingwood Turkyilmazoglu Lingwood Garrett example literature shows increasing suction stabilising effect general class Bödewadt Ekman von Kármán BEK flows results increase critical Reynolds numbers onset convective absolute instabilities narrowing range unstable parameters decrease amplification rates unstable convective modes convective instability results interpreted terms delay onset spiral vortices absolute instability results terms onset laminar turbulent transition Lingwood ',

'paper present experimental observations solvents vary TPA TPF properties fluorescent rhodamine Rh dyes Rh G RhB Rh Rhodamines well known xanthenes dyes extensively used many widespread applications single molecule detection DNA sequence determination fluorescence labelling etc due strong fluorescence visible spectral region Molecular geometries rhodamine dyes well known indicate structures non centrosymmetric general centrosymmetric molecules TPA forbidden tuned transitions one half excitation frequencies However non centrosymmetric molecules due symmetry relaxations single photon absorption SPA peaks TPA peaks may coincide set primary aim find effect solvent polarity correlation SPA TPA peaks dyes ',

'methods enhancement photocatalytic activity grafting co catalysts two kinds co catalysts terms function one separation electrons separation holes former representative co catalysts Pt Fe Cu reported Fe Cu grafted amorphous oxide cluster reduced Fe Cu receiving one electron respectively reduced metal oxide cluster reduced ions could return original state giving one electron molecular oxygen latter ones CoOx CoPi CoPOx IrOx RuOx used water oxidation among CoPi reported effective co catalyst water oxidation However reports concerning co grafting effects photocatalytic activity especially gaseous phase expected co grafting co catalysts separations electrons holes photocatalytic activity gaseous phase would enhanced Moreover complex BiVO materials p type semiconductor also effective enhancing photocatalytic activity ',

'obvious metric measure monitoring performance different conditions would compare many clicks users made average condition Furthermore interest buffer values respective buffers time user s interaction simulation e g input buffer certain machine time refilling relatively high average buffer value e g signify users trust respective mode process monitoring conveys need interaction time leading users switching attention process simulation regular intervals performing interactions case low average buffer hand signify users rely respective conditions ability signal interaction needs hand e g input buffer already completely depleted time intervention may signify respective condition failed inform users time many cases participants used double clicks interactions single click would sufficient fact perhaps communicated clearly enough participants Therefore several clicks performed directly one another first click taken account ',

'developed systematic quantified understanding specific problem design mobile friendly unique identifiers results also apply design text based services trend toward bespoke adaptive keyboards e g Dunlop Levine Karrenbauer Oulasvirta Leiva et al Wiseman et al often though input devices fixed constraint design service users typing keyboard came phone keyboards advantages limitations quirks mode switching touchscreen keyboards require reach numbers capital letters root design improvements propose paper designing services vital aware fixed constraints system focus aspects service s design controlled Making changes input data way cheap quick easy way improve user experience ',

'data acquisition strategies must balance relevant scales volumes datasets used physical statistical modeling Approaches extraction necessary information must able disregard spurious information develop working network models active mechanism related degradation pathway mesoscopic physical level data driven statistical model level capture temporal evolution energy material long time frames appropriate informatics methods needed balance data volume e g simple univariate time series data streams high dimensional volumetric imaging datasets considering respective information contents raw data extracted information must accessible query modeling Similarly modeling approaches used understand parameterize active mechanisms phenomena lifetime fall broad categories micro meso macroscopic approaches Laboratory real world experimentation informatics analytics development network models mesoscopic evolution energy materials lifetime together constitute field degradation science ',

'first principles calculations performed using Cambridge Serial Total Energy Package CASTEP implements plane wave pseudopotential DFT method exchange correlation functional approximated using generalized gradient approximation PBE GGA electron ion interactions described Vanderbilt type ultrasoft pseudopotentials plane wave basis set truncated cutoff eV Brillouin zone sampling performed using Monkhorst Pack scheme k point spacing reciprocal space Å Tests show computational parameters give results sufficiently accurate present purposes ferromagnetism nickel accounted performing calculations using spin polarization starting ferromagnetic initial configuration relaxing towards ground state However compositions considered ground state electronic structure alloy found exhibit weak ferromagnetism effect thought influence phase stability Table shows calculated equilibrium lattice constants  $\eta$  phase various Ti concentrations using partially ordered  $\eta$ P structures change lattice constant upon Ti alloying relatively small related larger covalent radius Ti calculate d lattice constants good agreement experimental values relate alloy Al Ti ratio ',

'Probabilistic stochastic approaches facilitate search local global optima Evolutionary



algorithms genetic population Jomier et al Rivest Henault et al Ruijters et al considered strategy less likely get stuck local optimum Ruijters et al cost function consisting sum Gaussian blurred intensity values DSA projected model points Jomier et al optimized using genetic algorithm optimizer authors use Condensation form sequential Monte Carlo sampling estimate cost function gradient Florin et al finding global minimum Besides Kalman filter successfully adopted Curwen et al Feldmar et al Toledo et al ',

'volunteers AAMM technique significantly p outperformed two methods intervals seen comparing error curves shown Fig figures Table supplementary materials Significance assessed using tailed Wilcoxon signed rank test since error distributions generally symmetric estimation errors AAMM non adaptive counterpart AAMM adapt similar beginning application phase anticipated application phase went AAMM technique continually improved accuracy incorporating data model average motion estimation AAMM improved T respect non adaptive counterpart However method already significantly adapted breathing pattern T i e min imaging motion estimations average accurate beginning adaptation phase visually inspecting curves AAMM Fig seen many volunteers particular volunteers E F error curves start flatten approximately around min mark concluded longer calibration scan around min would optimal min used calibration experiment plus min worth data added application phase Note time could significantly reduced non cardiac gated sequence used ',

'formulate downscaling problem multi objective optimization problem face however following problems Minimizing sum different objectives problematic since may different units ranges Even appropriate scaling procedure risk treating objectives unequally getting trapped local minimum Firstly never know minimum value objective achieved regression Thus designing appropriate scaling procedure difficult one would need decide relative importance different objectives advance Secondly adding multiple conflicting objectives likely results fitness function multiple local minima makes optimization difficult avoid problems implemented fitness calculation according Strength Pareto Evolutionary Algorithm SPEA Zitzler Thiele instead using single weighted fitness cost function Approaches multi objective optimization like SPEA widely used evolutionary computation SPEA fitness calculation fitting procedure based intercomparison different models finite set called Pareto optimal models downscaling rules returned ',

'main objective manuscript present discuss application SLAMM New York coast Although base analysis considers range different possible SLR scenarios effects various sources uncertainties input parameters driving data accounted addition refined site specific data often available requiring use regional data collected literature professional judgement order run model ignore effects uncertainties predictions may make interpretation results subsequent decision making misleading since likelihood probabilities predicted outcomes would unknown unique capability current version SLAMM ability aggregate multiple types input data a uncertainty create outputs accompanied probability statements confidence intervals Uncertainty elevation data layers considered several modeling groups various extents Gesch Gilmmer Ferdaña Schmid et al However best knowledge marsh migration model simultaneously accounts combined effects uncertainty spatial inputs DEM VDATUM etc parameter choices accretion rates tide ranges etc landcover projections added feature SLAMM allows results evaluated terms likelihood occurrence respect input data parameter uncertainties assigning wide ranges uncertainty appropriate permits production meaningful projections areas high quality local data available ',

'Using measured data two arable sites UK shown lags significant impact model evaluation affect level correlation measured simulated data magnitude sums residuals Also used division MSE three constituent statistics SB SDSD LCS show level correlation affect sum residuals dividing algorithm predicted series lag values monthly sets examining frequency distribution lags certain patterns temporally patchy series identified challenging task relation time lags observed simulated daily data determine cause task becomes difficult model outputs soil N O emissions driven various interacting variables Even measured N O datasets measured datasets drivers e g soil moisture soil N content cover small time periods continuous vary widely size study implemented algorithm using measured simulated data soil moisture first second example soil mineral N second example compared results respective results N O first example showed estimated lags N O prediction related lags soil moisture prediction way changes gradually time second example lags N O prediction explained lags soil moisture soil mineral N prediction positive relationship ',

'representing wetland river interactions involving GIWs many models assume wetland discharge river receive overbank flows models volume water water level elevation wetland corresponding threshold value predominantly controlled outlet elevation prime determinants wetland outflow Feng et al Hammer Kadlec Johnson et al Kadlec Wallace Powell et al Voldseth et al Wen et al Zhang Mitsch However regions characterised widespread riparian wetlands hydraulically connected adjacent rivers wetland river interaction likely bidirectional interactions quantified according hydraulic principles involving relative river wetland water level elevations well properties connection two Kouwen Liu et al Min et al Nyarko Restrepo et al WATFLOOD model instance riparian wetland river interaction modelled using principle Dupuit Forchheimer lateral radial groundwater flow Kouwen Since exchange riparian wetlands rivers occur surface and or subsurface Restrepo et al incorporated equivalent transmissivity expression obtained wetland vegetation subsurface soil Darcy flow equation MODFLOW model ',

'Typical physically based D flood models solve Shallow Water Equations SWEs requiring hi

gn computational resources Many models developed obtain better performance maintaining required accuracy reducing complexity SWEs reduction usually achieved approximating neglecting less significant terms equations Hunter et al Yen Tsai JFLOW model Bradbrook et al Urban Inundation Model UIM Chen et al diffusive version LISFLOOD FP Hunter et al solve D diffusion wave equations neglect inertial local acceleration advection convective acceleration terms Yen Tsai inertial version LISFLOOD FP Bates et al solves SWEs without advection term either version LISFLOOD FP flow decoupled Cartesian directions models use full SWEs focus use multi resolution grids irregular mesh like InfoWorks ICM Innovyze MIKE FLOOD DH I Software Hénonin et al last two models commercial packages code applied optimisation techniques public domain ',

'particular case survey data used iUTAH Utah Water Survey implemented participating researchers several Utah institutions higher education objectives survey document representative cross section Utah s adult population thinks water issues survey included three core blocks questions perceptions adequacy local water supplies perceptions quality local water resources concern range water non water issues number additional questions captured information respondents familiarity water cost lawn watering behaviors participation water based recreation demographic attributes Supplementary material paper includes document description dataset whole document containing complete survey instrument two data files containing results associated codebook see Section ',

'purported advantages EMR implementation urban slums widely promoted Increasingly capable health information systems could facilitate communication help coordinate care improve continuity care disadvantaged communities like Kibera However available systems may ability simplify care improve efficiency funding human resources scarce infrastructure unreliable health data demands opportunistic strategic study described perceptions local EMR stakeholders two urban slum clinics shared many observations may important EMR initiatives heed worried sustainability EMR initiatives like communities future EMR use urban slums promising Innovative new technologies mobile applications point of care laboratory tests could extend reach EMRs infrastructure wanting New cloud based EMR ecosystems data collected stored centrally could leverage cell phone networks promote health information sharing coordination care ultimately better outcomes vulnerable populations Summary points What already known topic Rapid urbanization associated growth number size urban slums associated rise burden disease worsening already fragmented inefficient health care system ',

'Isogeometric analysis IGA numerical simulation method directly based NURBS based representation CAD models exploits tensor product structure dimensional NURBS objects parameterize physical domain Hence physical domain parameterized respect rectangle cube Consequently singularly parameterized NURBS surfaces NURBS volumes needed order represent non quadrangular non hexahedral domains without splitting thereby producing compact convenient representation The Galerkin projection introduces finite dimensional spaces test functions weak formulation partial differential equations particular test functions used isogeometric analysis obtained composing inverse domain parameterization NURBS basis functions case singular parameterizations however resulting test functions necessarily fulfill required regularity properties Consequently numerical methods solution partial differential equations applied properly We discuss regularity properties test functions one two dimensional domains consider several important classes singularities NURBS parameterizations specific cases derive additional conditions guarantee regularity test functions addition present modification scheme discretized function space case insufficient regularity also shown results applied computational domains higher dimensions parameterized via sweeping ',

'discussion also lays bare difference perspectives fusion hard constraints knowledge based merging idea Konieczny Pino Perez explain fusion plain epistemic states understood set plausible worlds existence underlying partial orderings numerical plausibility degrees obtained distances based axioms use plausible sets attached orderings authors use hard integrity constraints belief sets referring plausible worlds try extend AGM revision knowledge based merging However envisage merging integrity constraints discussed previous section belief revision merging literature takes external point view cognitive processes study underlying ordered structures consequence merging postulates appear explicitly axioms observable outside contrary approach construct fusion rules rely explicitly supplied sources sequel consider counterpart fusion postulates ranked models expressed means total orders possible worlds encodings plausibility scale ',

'Methods anomaly detection local context conceptual opposite afore described centralized methods rely globally shared models data mining notion locality often given distance data values given specific distance metric Euclidean distance data point compared value nearest neighbors terms data distance However notion locality also given geographical distance sources data Many similar values i e data small distance among result higher density called clusters values less similar result lower density Anomalies fall outside cluster frequently occurring form cluster Determining datum normal anomalous compared local neighborhood data challenge ',

'MWSN routing protocols generally take influence WSN mobile ad hoc network MANET routing protocols share common limitations bandwidth power cost WSNs often share aim MWSNs wish route data many sensors single sink However WSNs normally considered static associated routing protocols often unable cope mobile scenario Alternatively MANET protocols designed able cope mobility nodes however aim allow end to end communication occur two nodes extra functionality often required MWSNs additional overhead unnecessary Combined high packet d

delivery ratios low delays demanded emerging applications ideal routing solution MWSN one handle mobility nodes allows data forwarded sensors sink reliable timely manner set requirements make problem routing MWSN unique challenge require new specifically designed solutions reason many routing protocols designed MWSNs section give overview current literature highlights different techniques commonly used protocols MWSN routing ',

'future work protocol would promote two items Firstly two mobility models considered work propose possible way capture social context way nodes move physical space yet still potentially allowing nodes explore geographical regions considered entirety insights performance potential could given assessment protocol mobilities extend physical region movement well impose potential restrictions nodes mobility example forcing similar nodes move with in specifically defined areas Secondly different forwarding modes introduced Section express different levels cooperation across network push community mode example form interest community selfishness assumes reciprocation nodes behaviour vulnerability resp resilience protocol different instances node misbehaviours research item worth exploring ',

'proposed multihop routing protocol PHASer applies technique blind forwarding MWSN increases reliability data delivery inherent use multiple routes approach requires gradient metric continuously maintained problematic dynamic topology literature commonly uses either flooding location awareness however flooding creates large amounts overhead location determination schemes often inaccurate power hungry create issue dead end problem PHASer uses novel method gradient maintenance mobile network requires proactive sharing local topology information facilitated global TDMA time division multiple access MAC medium access control layer reduces amount overhead turn decrease packet latency PHASer also set apart use encapsulation allows data multiple nodes transmitted packet order handle high volumes traffic utilises node cooperation create robust multipath routing solution contribution paper cross layer routing protocol MWSNs handle constant flow data sensors highly mobile situations ',

'Superconductivity actinides first observed thorium metal elemental uranium uranium compounds new class uranium superconductors emerged s discovery uranium heavy fermion superconductors surprises came beginning century discovery ferromagnetic superconductors uranium systems first observation superconductivity plutonium neptunium compounds actinides actinoids located end periodic table N Ac Th Lr Transuranium elements transuranics chemical elements atomic number Z greater uranium due short half life geological timescale essentially synthetic elements Z Lr one talks transactinides superactinides elements latter elements extremely short half lives macroscopic quantity available study condensed matter properties ',

'PV cells one promising technologies conversion incident solar radiation electric power However technology still far able compete fossil fuel based energy conversion technologies relatively low efficiency energy density Theoretically three unavoidable losses limit solar conversion efficiency device single absorption threshold band gap  $E_g$  incomplete absorption photons energies  $E_g$  absorbed thermalization carrier cooling solar photons sufficient energy generate electron hole pairs immediately lose almost energy excess  $E_g$  form heat radiative recombination small fraction excited states radioactively recombine ground state maximum power output Hanna Nozik Henry Taking air mass example different band gap  $E_g$  three losses calculated results indicated areas S S S Fig Note area outer curve solar power per unit area S delivered load ',

'Xylanases potential applications various fields important applications fallows Xylanase s used bleaching agent pulp paper industry Mostly used hydrolyzed xylan component wood facilitate removal lignin Viikari Kantelinen Buchert Puls also helps brightening pulp avoid chlorine free bleaching operations Paice Jurasek Ho Bourbonnais Archibald bakeries xylanase act gluten fraction dough help even redistribution water content bread Wong Saddler Xylanases also potential application animal feed industry used hydrolysis non starchy polysaccharides arabinoxylan monogastric diets Walsh Power Headon Xylanases also play key role maceration vegetable matter Beck Scoot protoplastation plant cells clarification juices wine Biely liquefaction coffee mucilage making liquid coffee recovery oil subterranean mines extraction flavors pigments plant oils starch McCleary improve efficiency agricultural silage production Wong Saddler ',

'ObjectiveElectrically evoked auditory steady state responses EASSRs neural potentials measured electroencephalogram EEG response periodic pulse trains presented example cochlear implant CI EASSRs could potentially used objective CI fitting However EEG signals contaminated electrical CI artifacts paper characterized CI artifacts monopolar mode stimulation evaluated pulse rate linear interpolation signal part contaminated CI artifact successful MethodsCI artifacts characterized means amplitude growth functions duration ResultsCI artifact durations ms contralateral recording electrodes ipsilateral recording electrodes CI artifact durations range larger ms ConclusionAt contralateral recording electrodes artifact shorter interpulse interval across subjects pps always case pps SignificanceCI artifact free EASSRs crucial reliable CI fitting neuroscience research CI artifact characterized linear interpolation allows remove contralateral recording electrodes stimulation pps ',

'order test whether haptic patterns convey enhance mood music movie affective movie clip corpus required consisting clips labeled according emotion conveyed mood music following database collections examined possible sources corpus Emotional Movie Database EMDB Film Stim Howeverdiscarded review unsuitable aim study enhance mood film score case clips EMD

B audio provided deemed clips unsuitable case Film Stim database clips French rather English subtitles also deemed unsuitable since studies carried English speaking participants Furthermore Film Stim selection based affective content narrative music also unsuitable discussed review available database collections found present standard corpus affective movie clips affective indexing referred musical score clip ',

'One way enforce ratio use probabilistic roulette wheel style lane selection policy VISSIM along simulation toolkits offers methods specify probabilistic routing whereby defined percentage vehicles sent unique routes piecewise technique reapplied various locations around simulation methods attractive calibration perspective exact representations existing statistics ensured process unrealistic one assumes drivers make probabilistic decisions precise locations case vehicle arrives point prior weighbridges allocated one lanes based respective probabilities turns method leads significant variations trip times depending initial random number seed seen graphic key areas simulation different runs Fig One benefits graphical microsimulation D D simulations help researcher visualise new scheme potential benefits also highlight unrealistic behaviour Fig shows congestion decision point different runs Using probabilistic routing enforce correct routing percentages clear case over calibration affecting simulation brittleness ',

'studies within physiological domain special relevance work include performance analysis blood flow LB solver using range sparse non sparse geometries performance prediction model lattice Boltzmann solvers performance prediction model applied largely HemeLB application although HemeLB uses different decomposition technique performs real time rendering visualisation tasks LB simulations Mazzeo Coveney studied scalability earlier version HemeLB However current performance characteristics HemeLB substantially enhanced due numerous subsequent advances code amongst others improved hierarchical compressed file format use ParMETIS ensure good load balance coalesced communication patterns reduce overhead rendering use compile time polymorphism avoid virtual function calls inner loops ',

'Although mean field models used settings little analysis done behaviour spatially extended dynamical systems part due staggering complexity Liley model considered instance consists fourteen coupled Partial Differential Equations PDEs strong nonlinearities imposed coupling mean membrane potentials mean synaptic inputs model reduced system Ordinary Differential Equations ODEs considering spatially homogeneous solutions resulting system examined detail using numerical bifurcation analysis see references therein order compute equilibria periodic orbits objects PDE model need flexible stable simulation code model linearization run parallel scale domain size cm size full grown human cortex also need efficient iterative solvers linear problems large sparse matrices paper show accomplished open source software package PETSc implementation consists number functions C available publicly ',

'virtualization technologies certainly reduce complexity using system especially working across multiple heterogeneous computing environments widely deployed high performance computing scenarios name suggest HPC seeks obtain maximum performance computing platforms Extra software layers impact detrimentally performance meaning HPC scenarios users typically run applications close bare metal possible addition performance degradation introduced virtualization technologies choosing details abstract virtualized interface important Grid cloud computing support different interaction models grid computing user interacts individual resource sometimes broker order launch jobs queuing system cloud computing users interact virtual server effect putting control complete operating system interaction models put onus user understand specific details system dealing making life difficult end user typically scientist wants progress scientific investigations without specific usability hurdles obstructing pathway ',

'FabHemeLB Python tool helps automate construction management ensemble simulation workflows FabHemeLB extended version FabSim configured handle HemeLB operations FabSim FabHemeLB help automate application deployment execution data analysis remote resources FabHemeLB used compile build HemeLB remote resource reuse machine specific configurations organize curate simulation data also submit HemeLB jobs remote resource specifying number cores wall clock time limit completing simulation tool also able monitor queue status remote resources fetch results completed jobs conveniently combine functionalities single one line commands general FabHemeLB commands following structure ',

'relevant studies information dissemination transportation systems using simulations One category studies look either local information neighbours global information entire network affects global network performance approach different sense investigate impact information global network performance depending fraction people receive information analyse effect real time information dissemination explain effect appears Information disseminated real time contains global details congested roads approach important gives insights impact massive use real time information traffic useful building intelligent traffic control mechanisms information steering tool ',

'Generalized polynomial chaos expansions One approach model densities stochastically dependent components numerically reformulate uncertainty problem set independent components generalised polynomial chaos expansion described detail Section Rosenblatt transformation allows mapping domain unit hypercube D double transformation reformulate response function  $f(x) = Q(f_1(x_1), \dots, f_n(x_n))$  where  $x_i$  are independent random variables drawn from  $p_i$  simplicity chosen consists independent components Also  $\phi_n$  are constructed orthogonal respect LR LQ case R either selected Askey Wilson scheme calculated using discretized Stieltjes procedure remainder

rk accuracy approximation deteriorate transformation composition TQ TK smooth Dakota Turn s Chaospy support generalized polynomial chaos expansions independent stochastic variable s Normal Nataf copula listed Table Since Chaospy Rosenblatt transformation underlying computational framework generalized polynomial chaos expansions fact available densities ',

'Aspect oriented Programming AOP well solve cross cutting concerns different features aspect AOP requires new techniques testing First paper proposes model test aspect oriented software order support testing model first three steps propose algorithm selecting aspect relevant test cases develop new tool implement theoretical automating select test case Finally case Bank Account System studied illustrate testing approach ',

'paper design varnish plant Crocodile Matchet Limited Tema Ghana considered modification made eliminate blooming rusting product final processing plant high moisture content atmosphere proposed design included pipelines ducts and hot air receiving chambers Varnish Plant Heat exhaust gas would otherwise gone wasted utilised redesigning varnish plant yielded kW heat energy transferred air chambers aid drying of matchets hardening plant Consequently absorption moisture steel dryness product improved studies done ensure constant supply hot air air chambers ',

'Digital libraries promise new societal benefits especially e learning digital mobile times starting elimination time space constraints traditional bricks and mortar libraries library information professionals required acquire knowledge skills library one highly influenced service profession paper gives overview current trends digital library research consists digital library characteristic advantage disadvantages function paper also highlights impact information technology traditional library ',

'According situation students meet software industry demand qualified personnel triple driven three dimensional software development practical teaching system proposed aiming improve software development capabilities innovation sense students system effectively improve students interest software development practical skills sense innovation laying solid foundation student graduation rapidly integrate software development process meeting needs software industry ',

'According shortcomings long time big errors moving plate recognition system present moving plate recognition algorithm based principal component analysis PCA color extraction basis analysis moving plate recognition system s basic principles introduces basic principles calculation steps PCA extraction algorithm discusses feasibility applying algorithm PRS paper experimental results show algorithm advantages faster speed higher accuracy recognition algorithm provides new thought research moving plate recognition algorithm ',

'development sport normal students china ideas teaching learning view learning simple process knowledge become outdated ineffective therefore order improving quality teaching learning sport normal students china author discussed factors promoting level teaching learning sport normal students implementation principle curriculum design education policy meaning results implication future research discussed ',

'process driven model presented build instinctive efficient higher educational administrative management system overcome problems universities facing model processes identified explicitly routine educational administration broken small tasks task designated role executors process describes activities relationships among prototype higher educational administrative system built Bonita open solution demo shows process driven higher educational administrative system helps end users understand processes involved focus ',

'employment utilizing investigation expert interviews comparison article investigates curricula construction curricula design curricula content sports free normal students basis investigation article analyzed theoretical framework curricular construction proposed suggestions hope provide evidences curricula design sports free normal students ',

'century since emergence lettered words development economy culture increase international contacts communication China foreign countries lettered words appearing frequently Lettered words become indispensable part Chinese vocabulary WTO Ka la OK MP new phenomenon vocabulary system modern Chinese lettered words draws lot academic attention Ecolinguistics new branch linguistic combine linguistic ecology paper trying analyze lettered words perspective Ecolinguistics paper discuss reasons appearing lettered words influence may give modern Chinese form ecolinguistic view ',

'st century face aging population trend health status elderly hot issue social concern therefore explore health status Chinese population aging elderly elderly fitness exercise Misunderstanding study formulate measures methods fitness elderly promoting elderly fitness training towards healthy scientific direction promote nationwide fitness activities carried order achieve exercise scientific fitness older persons ',

'Faced deficient ability autonomic learning among learners low emotional involvement current web based instructional environment propose construct model based intersubjectivity fusing cognition emotion make shortages put construct model practice online teaching reform quality course apparel production management ',

'paper present algorithms automatic generation logic reasoning questions algorithms able construct questions solvable unique solutions algorithms employ AI techniques semantic networks produce verbal questions algorithms small size able replace traditional question databases particularly suitable implementation memory constrained mobile platforms algorithms applied question generation job interview civil service exam etc ',

'referring many relevant data essays paper aims discussing analyzing importance hip push applied walking race based point view sports biomechanics With regard existing problems a

authors made objective analysis sports biomechanics factors influence race hoping provide theoretical basis deep development training walking race ',

'A model proposed modeling data centric Web services powered relational databases interact users according logical formulas specifying input constraints control flow constraints state output action rules Linear Temporal First Order Logic LTL FO formulas inputs states outputs actions used express properties verified We proven automatic verification LTL FO properties data centric Web services input bounded constraints decidable reducing Web services data centric Web applications Thus verify Web service specifications using existing verifier designed Web applications ',

'important goal software industry produce successful product process production several times product fails due lack proper management paper exploring role software engineering courses computer engineering related branches reasons software developers lack project management proper software management trainings findings reflect majority computer related branches like computer science computer engineering information system engineering place software project management course findings based survey course curriculums computer engineering computer science information system engineering courses taught Turkish universities ',

'Analyzing significance macroscopical dynamic monitoring new add construction land considering influence various factors paper selected Yinchuan Plain typical experimental zone built knowledge base remote sensing images interpretation used multi temporal remote sensing images carried interactive interpretation change patterns new add construction land field validation Interpretation results m scale remote sensing image show minimum spot average area new construction land change monitored m scale remote sensing data acres ability m scale remote sensing data identifies new increased construction land change strengthens shows recognition smallest spot area reduces recognition accuracy increases ',

'Evolutionary Algorithms stochastic optimization methods simulating behavior natural evolution algorithms basically population based search procedures efficiently dealing complex search spaces robust powerful search mechanism EAs highly applicable multiobjective optimization problem conflicting objectives paper reviews work carried diversity convergence issues EMO ',

'paper coordination problem agricultural products supply chain stochastic yield studied based prices compensation strategy agricultural producing influenced natural conditions yield uncertain agricultural products rigid demand goods fluctuations yield cause greater volatility prices two echelon supply chain one supplier one retailer studied mathematical model constructed model showed prices compensation strategy Pareto improvement agricultural products supply chain stochastic yield also incentive agricultural products supplier rise production plan balance profit allocation supply chain ',

'difficult directly predicting permeability porosity tight sandstones due poor relationships core derived porosity permeability caused extreme heterogeneity classical SDR Schlumberger Doll Research Timur Coates models unusable enough core samples drilled lab NMR experimental measurements calibrate involved model parameters Based classification scale method CSM target tight sandstones classified two types relationship core porosity permeability established every type formations corresponding permeability estimation models established Field examples show classification scale method effective estimating tight sandstone permeability ',

'opportunity offered digital technologies make deep rationalization purchase supplies becoming indispensable competition enterprises considering positive effects reducing costs companies adopted E Procurement confirmed numerous case studies automation procedures purchase e procurement technology enables companies achieve reduction costs average total purchases web based models playing critical role within companies especially generation value supply chain article focuses role e procurement within supply chain showing simulation advantages difficulties implementing systematic use Internet defining basic structure e supply chain ',

'present paper hypergraph model structural system modeling reconfigurability analysis presented first represent system equation hyperedge extend modeling hypergraph others colored hyperedges red blue allows us perform analysis task Based bottom analysis hypergraph model s easy check system reconfigurability presence fault verifying existence paths affected hyperedge specifics blue hyperedges passing specifics red hyperedges method illustrated pedagogical example ',

'paper suggests design high quality real time rotation face detection architecture gesture recognition smart TV high performance rotated face detection multiple MCT Modified Census Transform architecture robust lighting change used Adaboost learning algorithm used creating optimized learning data proposed hardware structure composed Color Space Converter Image Resizer Noise Filter Memory Controller Interface Image Rotator Image Scaler MCT Generator Candidate Detector Confidence Switch Confidence Mapper Position Resizer Data Group Overlay Processor Color Overlay Processor result suggested face detection device conduct real time processing speed least frames per second ',

'Based expectation maximization algorithm parameter estimation proposed data driven nonlinear models work basis particle filters used approximately calculate integrals deriving EM algorithm based particle filter effectiveness using proposed algorithm soft sensor COx content tailgas PX oxidation side reactions verified simulation results ',

'paper present project aiming integrating immersive virtual reality technologies three d

dimensional virtual world use educational platform VAcademia test bed project focus improving learning process subsequently outcomes aim increasing immersiveness D virtual world experience applying motion tracking controlling avatar two technologies natural navigation immersive projection head mounted display addition propose major types learning scenarios use designed systems ',

'order solve problem diesel engine PT fuel system unable field maintain developed portable signal acquisition analysis system diesel engine PT fuel system Firstly PT pump work Principle analyzed PT pump failure mapping relation reason failure phenomenon analyzed Secondly diesel engine PT pump failure fuel pressure characteristics analyzed Lastly using portable signal acquisition analysis system diagnose diesel engine PT fuel system experiment results show system correctly detect diesel engine PT fuel system state ',

'behavior cellular beam described using design methods according BS considering particularly strength tee sections web post element behavior derived parametric study involving finite element analysis using software ANSYS design method based plastic analysis beam section ultimate loads elastic analysis serviceability loads procedure design cellular beam illustrated example based design method worked verification done checking suitability ',

'low carbon economic development become trend orientation regional economic development residents Heilongjiang province consumption direct way achieve low carbon lifestyle Based research discussion connotation low carbon consumption culture behaviour preferences habits concluded low carbon consumption requires us abide life style knowledge culture Therefore obvious development low carbon economy complex systematic project involved economic development mode technological innovation mode consumption values changes lifestyle ',

'paper presents results studies effect multiwalled carbon nanotubes nm concentrations mg ml diatoms Pseudo nitzschia pungens clone PP golden alga Isochrysis galbana clone TISO toxic effects multiwalled nanotubes types algae revealed results decrease linear dimensions cells chloroplasts reduced number cells incubated h Pseudo nitzschia pungens hours Isochrysis galbana ',

'retrospective assessment environmental carrying capacity aims obtain historical development situation reclamation domain s essential tool improving managed level guiding environmental management reclamation paper synthetic assessment method based cloud theory applied evaluate single factor multiple factors environmental carrying capacity CaoFeidian marine district Tangshan Bay China field data five assessment indexes recent six years assessment results obtained show marine reclamation certain impact marine environment ',

'study focused water gas shift reaction WGSR occurring chemical kinetics equipment used increase hydrogen recovery industrial processes research deals comparing hydrogen recovery use three different catalysts amount produced hydrogen depends considerably reaction state catalyst composition improve course reaction natural catalysts calcite coal char unburned residues coal modified olivine added gasification process heated process temperature °C ',

'Several inorganic flocculating agents including FeSO<sub>4</sub> Al<sub>2</sub>SO<sub>4</sub> FeCl<sub>3</sub> organic coagulant aid PAM used treat wastewater domestic animal poultry breeding paper ideal operating conditions attained single factor experiment orthogonal design experiment ideal operating conditions follows dose FeSO<sub>4</sub> PAM mg/L mg/L respectively keeping pH corresponding removal rate COD turbidity Based experimental results paper analyzes main factors affect wastewater flocculation treatment ',

'Many models propounded forecasting lightning Though majority model shown accuracy response time detecting natural phenomenon quite low model used mathematical experimentation micro scale plasmas develop macro scale atmospheric plasma believe major influence lightning Schrödinger electrostatic algorithm propounded increase accuracy alacrity detecting natural phenomena According theoretical experimentation air density plays major role lightning forecast guess verified using Davis Weather Station track air density upper lower atmosphere air density upper atmosphere showed prospect vital factor lightning forecast ',

'Design semantics integration human mode existence view culture art means unity art science Design semantics annotation form reflection symbolic meaning means explanation deposited human cultural spirit Chinese art stresses Expression Force Qi China people advocate learn nature look observe sun moon stars look observe surroundings take Nature Man One highest state spirit Design semantics expressed space environment design symbiotic philosophical view natural artificial forms complementary interactive form design leads humans back better state living i.e. Nature Man One ',

'acknowledged megalopolises playing leading role processes economic development culture change Thereupon new emphases sustainability transportation system megalopolis creating new demands adequate approach measure performance diagnosis potential drawbacks examining descriptions sustainable transport system well evaluating approach framework general applicability easily accessible data resource evaluating sustainability transport system megalopolis developed based nature regional structure feature transport demand megalopolis proposed framework applied analysis comparison Jing Jin Ji Yangtze River Delta ',

'paper consider problems creating introducing intelligent management systems one important mechanism increasing energy efficiency industry Operating principles intelligent electric power distribution systems developed MSTU STANKIN AC/DC grids industrial plants described Essential devices composing systems considered technical characteristics described Experimental results presented In paper consider problems creating introducing intelligent management systems one important mechanism increasing energy efficiency industry Operatin

g principles intelligent electric power distribution systems developed MSTU STANKIN AC DC grids industrial plants described Essential devices composing systems considered technical characteristics described Experimental results presented ',

'Along expansion computer based climate simulations efficient visualization analysis massive climate data becoming important ever paper try explore factors behind climate change s combining window query time varying data mining techniques constant query time acceptable storage cost algorithms presented support various queries d time varying datasets average min max value new time varying data analysis algorithm given especially suitable analyzing big data algorithms implemented integrated visual analysis system tiled LCD ultra resolution display Experimental results several datasets practical applications presented ',

'Improving well evaluating performance High Performance Computing HPC applications migrating Cloud environments widely considered critical issues field high performance Cloud computing However poor network performance heterogeneous dynamic environments series pitfalls execution HPC applications Cloud paper proposes new approach improve performance scalability HPC applications Amazon s HPC Cloud evidence approach points significant improvement speed scale response rate percent parallel efficiency Cloud comparison dedicated HPC cluster state EC Cloud system feasible platform deploying on demand small sized HPC applications ',

'paper present extended version graph based unsupervised Word Sense Disambiguation algorithm algorithm based spreading activation scheme applied graphs dynamically built basis text words large wordnet algorithm originally proposed English Princeton WordNet adapted Polish plWordNet extension based knowledge acquired corpus derived Measure Semantic Relatedness proposed extended algorithm evaluated manually disambiguated corpus observed improvement case disambiguation performed shorter text contexts addition algorithm application expressed improvement document clustering task ',

'Sentence reduction one approaches text summarization attracted many researchers scholars natural language processing field paper present method generates sentence reduction applying Vietnamese text summarization using Bayesian Network model Bayesian network model used find best likelihood short sentence compare difference probability Experimental results sentences show method really effectively generating sentence reduction understandable readable exactly grammar ',

'Knowledge Management KM one hotspots research past decade cases number users Knowledge Management System KMS large varied departments even companies paper defects existing methods access control recommendation deployed KMS analyzed show widely used approaches need extended overcome deficiencies previous work paper proposes extended Role Based Access Control RBAC method hybrid recommendation approach Knowledge Management System Also real life system presented verify proposed methodology ',

'nonlinear wave equations difficult investigate mathematically general analytical method solutions exists Exponential Time Differencing ETD technique requires minimum stages obtain required accurateness suggests efficient technique relating to computational duration thus attains remarkable stability characteristics upon resolving nonlinear wave equations article solves diagonal example Kawahara equation via ETD Runge Kutta technique Implementation on technique proposed short Matlab programs ',

'Contractor selection project important decision one project time cost next quality obtained project Although project managers easily determine project time cost quality usually undefined especially un experienced managers learnable property approach first introduced paper quantify quality obtained gas well drilling project based three objectives time cost quality contractor selection problem converted optimization problem Next NSGA II algorithm utilized solution end sensitivity analysis performed select parameters algorithm ',

'paper regression analysis based method proposed calculate Journal Influence Score Influence Score used measure scientific influence scholarly journals Journal Influence Score calculated using various factors weighted manner Score compared SCImago Journal Score results show error small existing proposed methods proving model feasible effective way calculating scientific impact journals ',

'paper present tele operated mobile robot system old age surveillance robot operates autonomous mode robots navigates environment search unusual situation elderly people patient lying floor robot informs user user switches control mode autonomous haptic based user control autonomous mode robot utilizes visual sensor landmarks monitor entire environment robot equipped microphone speaker monitor making possible communicate user remote place addition robot utilizes vital sensors check patient s condition preliminary surveillance experiments show good performance ',

'Recently network virtualization technology attracted considerable attention one new generation network technologies paper order permit rapid changing topology virtual network propose new virtual network construction method based shortest path betweenness proposed method first service provider receives user s request reconfiguration constructed virtual network case service provider reconfigures topology constructed virtual network rapidly based shortest path betweenness evaluate performance proposed method simulation show effectiveness proposed method ',

'Security issues data hosted Cloud Computing provider remain hidden seen excessive marketing led totally unrealistic view cloud computing security Although Cloud Computing yet reached level maturity expected customers problems confidentiality integrity reliability c



consistency CIRK still open researchers field already considered future cloud strategy aim a better QoS reliability high availability Multi Clouds Cloud Clouds Interclouds This paper present security limitations single Cloud usefulness adopting rather Multi Clouds strategy reduce security risks use DepSky virtual storage system ensures better availability high confidentiality data ',

'paper presents general results Java source code snippet detection problem propose tool uses graph subgraph isomorphism detection number solutions tasks proposed literature However although solutions really fast compare constant static trees solution offers enter in put sample dynamically Scripthon language preserving acceptable speed used several optimizations achieve low number comparisons matching algorithm ',

'paper adaptive beamforming techniques smart antennas based upon Least Mean Squares LMS Sample Matrix Inversion SMI Recursive Least Squares RLS Conjugate Gradient Method CGM discussed analyzed beamforming performance studied varying element spacing number antenna array elements algorithm four algorithms compared rate convergence beamforming null steering performance beamwidth null depths maximum side lobe level ',

'paper three different approaches implementing quantum search algorithm adiabatic evolution shown expected either one provide quadratic speed opposed classical search algorithm implies adiabatic evolution based quantum computation gives feasibilities quantum circuit model although equivalence already proven corresponding literature ',

'paper implementation LBP local binary pattern based fast face recognition system symbian platform presented First face picture taken camera detected using AdaBoost algorithm Second pre processing face done including eye location geometric normalization illumination normalization face preprocessing rapid eye location method named ER Eyeball Search proposed implemented Last improved LBP adopted recognition Although computational capability sy mbian platform limited experimental results show good performance recognition rate time pressIn paper implementation LBP local binary pattern based fast face recognition system s ymbian platform presented First face picture taken camera detected using AdaBoost algorithm Second pre processing face done including eye location geometric normalization illumination normalization face preprocessing rapid eye location method named ER Eyeball Search proposed implemented Last improved LBP adopted recognition Although computational capability symbian platform limited experimental results show good performance recognition rate time press',

'Video oculography VOG one eye movement measurement methods key problem VOG accurately estimate pupil center pupil location method based morphology Canny algorithm proposed WIFI based VOG system developed latest work Moreover healthy volunteer introduced sinusoidal tracking test evaluate pupil location method Experimental results showed method could well trace eye movement meet anticipated results stimulation ',

'Hamiltonian approach variational approach utilized treat relativistic harmonic oscillator amplitude frequency relationship nice reliability shown result comparison open literature simplicity efficiency methods also disclosed different range initial amplitude looking amplitude frequency relationship nonlinear relativistic harmonic oscillator ',

'paper make explained variables financial stress index consist synchronous variables financial systemic risk make explanatory variables macroeconomic variable currency credit variable asset price variable macroeconomic variable correlative economic powers use stepwise regression method establish financial systemic risk best predict equation thus set reasonable practical financial systemic risk early warning index system besides use best prediction equations predicts financial systemic risk status predicted results show Chinese financial systemic risk rise first three quarters higher peak financial systemic risk start decline since fourth quarter ',

'Obstacle detection based inverse perspective mapping homography Obstacle classification based fuzzy neural network estimation vanishing point relies feature extraction strategy method exploits geometrical relations elements scene obstacle detected estimated homography road plane successive images used image alignment new fuzzy decision fusion method fuzzy attribution obstacle detection classification application described fuzzy decision function modifies parameters auto adapted algorithm get better classification probability shown method achieve better classification result ',

'load beam pumping unit changeable often state light load Reducing certain voltage improve power factor efficiency beam pumping unit light load We change voltage changing thyristor trigger angle complex unacceptable analyze change cycles load overall divide load whole cycle several equal parts thought constant load optimal voltage current load calculated genetic algorithm load optimal voltage get whole optimal voltage changeable rule produces result energy saving ',

'Based description model object orientation based direction relation two dimensional space description mode object orientation based direction relation three dimensional space proposed basic idea actual direction region modeled open shape computation related world boundary spatial direction region eliminated processing direction predicates converted processing topological operations open shapes closed geometry objects algorithms topological operations open shapes closed geometry objects presented theoretical proof correctness completeness algorithms performed ',

'sentence alignment modelbased combined clues Kernel Extensional Matrix Matching KEMM method proposed model similarity matrix sentence aligning formed similarities bilingual sentences calculated combined clues lexicon morphology length special symbols etc similarity

y matrix used construct select matrix sentence aligning finally obtains sentence alignments ts KEMM Experimental results illustrated model outperforms Gale s system handling types s sentence alignments total sentence alignment error rate decreasing A sentence alignment model based combined clues Kernel Extensional Matrix Matching KEMM method proposed model similarity matrix sentence aligning formed similarities bilingual sentences calculated combined clues lexicon morphology length special symbols etc similarity matrix used construct select matrix sentence aligning finally obtains sentence alignments KEMM Experimental results illustrated model outperforms Gale s system handling types sentence alignments total sentence alignment error rate decreasing ',

'paper deals computation distribution network components reliability parameters Knowledge e component reliability parameters power networks necessary reliability computation also reliability centered maintenance system Component reliability parameters possible retrieve e accurate databases distribution companies database includes records outages interruptions power networks impossible retrieve reliability parameters data direct way heterogeneity paper introduce results databases calculations apply framework retrieving parameters outage data Czech Slovak republics also actual results ',

'paper propose conceptual methodology control liquid state Al Si alloys melting holding sub process pressure die casting process Given determine characteristic holding furnace based weight percent wt certain alloys elements Subsequently paper introduces application methodology research establishing characteristic holding furnace application realized real conditions foundry uses horizontal cold chamber machine CLH chemical analysis performed spectrophotometer SPECTROLAB JR CCD Finally last part paper lists overall findings possible future direction extend methodology practice ',

'country rich line galloping many important galloping data failed collect systematically completely unified management platform galloping occurrence s winter department productive State Grid Corporation organized lot human carry research galloping information work time consuming inefficient State Grid Corporation used production management system PMS powerful easy use help system create galloping database save resources storage galloping data build put application database provide technical support line galloping prevention galloping researchwork ',

'paper presents non fragile controller design method based system quadratic performance optimization additive controller gain variations necessary sufficient conditions existence non fragile state feedback controller given transformed LMI problems simplifies solutions obtain non fragile state feedback controllers flight control simulation results prove reliability validity method ',

'fuzzy Hammerstein model predictive control method proposed continuous stirred tank reactor CSTR paper T S fuzzy model used approximate static nonlinear characteristics Hammerstein model linear autoregressive model used solve results optimal control designed nonlinear predictive controller using Hammerstein model make good use ability universal approach nonlinear T S model divide question nonlinear predictive control nonlinear model recognition question linear predictive control application results CSTR process show proposed control method good control performance compared PID controller ',

'key point robot dynamics optimal design control efficiency robot dynamics goal researchers recent years Screws used describe dynamic problems paper N recursive robot forward dynamic algorithm given easily extended tree topology closed loop spatial robot systems three classic methods robot dynamics compared easy use results show dynamics described screws helpful high efficient dynamics modelling dynamical expressions based screws concise clear s efficiency high N linear degree freedom improvement computation efficiency make real time dynamics control become possible ',

'algorithm multi axis NC tool path generation subdivision surfaces proposed algorithm includes two steps model building tool path generation section model building order obtain deformed surface deformation vector computed associated curvature slope cutter locations surface procedure tool path generation slicing procedure adopted get CL points addition inversely converted method used method tested examples actual machining results show method effectively reduce error scallop height subdivision surface obtain better shape quality addition computational complexity scalable robust ',

'Modeling approximating high dimensional computationally expensive problems faces exponentially increasing difficulty curse dimensionality paper proposes new form high dimensional model representation HDMR utilizing support vector regression SVR termed adaptive SVR HDMR conquer dilemma proposed model could reveal explicit correlations among different input variables underlying function unknown expensive computation Taking advantage HDMR s hierarchical structure could alleviate exponential increasing difficulty gain satisfying accuracy small set samples SVR Numerical examples different dimensionality given illustrate principle procedure performance SVR HDMR ',

'Metal intermetallic laminated MIL composites fabricated upon reaction sintering titanium aluminum foils various thicknesses intermetallic phase Al Ti forming processing gives high hardness stiffness composite unreacted titanium provides necessary high strength ductility results studies microstructure mechanical properties layered composites presented example Ti Al system Static dynamic tests results discussed case intermetallic reaction interrupted course intermetallic sintering also case completed ',

'design method network attack defense simulation platform discussed paper Firstly component functionplatform analyzed Visio second development method used construct virtual net

work topology parsing virtual network topology also researched relative flow sheet described Lastly example carried test performance platform Simulation results show effectiveness proposed method ',

'existing GO methodology algorithm theoretical hard solve computer paper research new method get reliability system based GO methodology According properties operators GO chart GO chart transformed series structure minimal path sets induced based Enumeration method first operator last one convenient computer calculate system reliability new method based minimal path sets case study indicates method suitable practical engineering used possess quantitative analysis complex GO methodology models ',

'number hidden nodes critical factor generalization ELM Generally heavy time consumption obtain optimal number hidden nodes trial and error novel algorithm proposed optimize hidden node number guarantee good generalization employs PSO optimization process structural risk minimization principle simulation results indicate algorithm optimal number hidden nodes reasonable feasible datasets benchmark problems accuracy comparisons ',

'providing government effective monitoring trends economic variables future good reference developing reasonable policy paper establish time series model China's Foreign Direct Investment FDI using wavelet analysis intervention analysis time series analysis predict trend FDI next several years model eliminates interference noise predicting using wavelet analysis describes autocorrelation time varying volatility financial time series using ARIMA GARCH M model simulation results show model explains dynamic structure China's FDI trends well ',

'Monitoring wear condition tramway superstructure one key points guarantee adequate safety level light rail transport system purpose paper suggest new non conventional procedure measuring transverse profile rails operation means image processing technique methodological approach based information contained high resolution photographic images tracks specific algorithms allow obtain exact geometric profile rails therefore measure state rail head extrados wear ',

'Robust automatic thresholding gray level images commonly used field pattern recognition computer vision objects detecting tracking recognizing Otsu scheme widely used image thresholding technique provides approving results segmenting gray level image one modal distribution gray level histogram However provides poor results histogram gray level non bimodal enhancing performance Otsu algorithm work improved median based Otsu image thresholding algorithm presented Finally extensive tests performed experiments show method obtain satisfactory results original Otsu thresholding algorithm ',

'paper novel position estimation method prism proposed single lens stereovision system prism multi faces considered single optical system composed refractive planes transformation matrix express relationship object point image refraction prism derived based geometrical optics mathematical model introduced denote position prism arbitrary faces parameters model extend application single lens stereovision system using prism widely area Experimentation results presented prove effectiveness robustness proposed model ',

'Power Grid reasoning expert system complex system solve knowledge sharing knowledge Base expert system abstract analyze power grid security investigation procedure using ontology Technology ontology based Power Grid knowledge base establish associated relationship procedure vocabularies paper introduce analyze semantic reasoning tools Jena reasoner mechanism inference rules grammar included explained last give specific application security investigation procedure ontology reasoning ',

'paper comparison two popular feature extraction methods presented Scale invariant feature transform SIFT first method Speeded robust features SURF presented second two methods tested set depth maps Ten defined gestures left hand depth maps Microsoft Kinect camera used capturing images Support vector machine SVM used classification method results accuracy SVM prediction selected images In paper comparison two popular feature extraction methods presented Scale invariant feature transform SIFT first method Speeded robust features SURF presented second two methods tested set depth maps Ten defined gestures left hand depth maps Microsoft Kinect camera used capturing images Support vector machine SVM used classification method results accuracy SVM prediction selected images ',

'figure demonstrates changes measure bitumen content create sizable differences stiffness modulus asphaltic samples include waste glass cullet percentage glass increases measure stiffness modulus modified asphalt increases pass optimum measure glass stiffness modulus asphaltic samples decrease trend total percentages bitumen content existing Due waste glass cullet suction trend extend measuring stiffness modulus asphaltic samples including waste glass cullet different percentage bitumen content Glass particles absorb bituminous material necessary decrease bitumen content addition glass cullet According Fig results Marshall tests optimum bitumen measures decrease significantly samples include higher percentages waste glass cullet percentage optimum bitumen content samples without waste glass cullet comparison asphaltic samples include waste glass cullet stiffness modulus asphaltic samples include waste glass cullet increased due additional interlocking aggregate angularity particles glass cullet content increase intrusive friction angle glass particles increased angularity main reason addition stiffness modulus asphaltic samples include waste glass cullet percentage glass content reaches greater particles abundance cause slip particles together stiffness modulus samples decreases percentage glass cullet increases variations stiffness modulus asphaltic samples include different percentages waste glass cullet different temperature shown Fig ',

phase completed Previous contracts procured contractor providing detailed design system design undertaken Mott MacDonald developed looking systems installed previously calculating actually required achieve cathodic protection piers resulted significant reduction number zones monitoring probes varying amounts steelwork beams previously lead zones per beam multiple layers mesh achieve design current density review data operating current density similar zones reduced single zone per beam encapsulation susceptible ASR contained post tensioning decided use galvanic system based Galvashield CC anodes Fosroc design include option allow depolarization galvanic system contractor supplied one anodes could remotely disconnected control unit Electrotech CP operated via broadband connection provided contractor ',

'innovative sound wall system developed University Western Ontario examined serve vertical extension existing sound walls wall system denoted flexi wall consists stay in place poly blocks formwork light polyurethane foam LPF reinforced steel rebars structural cores polyurea coating wall surfaces Fig Poly blocks interlocking light weight blocks stacked layer layer act formwork LPF cores poly block cm includes four cylindrical voids cm diameter made molded low density polyurethane weighs approximately kg poly blocks fire resistant blocks excellent capability absorb mitigate reflect wide range noises unmatched frequency reflective noise Polyurea coating abrasion resistant finishing layer sprayed surfaces wall sets within min layer also enhances surface resistance poly blocks stone impact weathering fire development chemicals penetration LPF expanding liquid mixture injected poly block voids cures within min Steel rebars epoxied holes drilled existing sound wall connect wall extension base ',

'Another important reason damages incurred RC buildings workmanship defects understood granulometry handmade concretes compliance standards since aggregate utilized sieved Also compaction process properly implemented general installment concrete RC buildings situation resulted concrete exhibit excessively porous structure fundamental rules thumb construction namely concrete cover taken care formwork workmanship Faults connections stirrups longitudinal bars unstaggered formation stirrup hooks beams columns perpendicular angles hooks inadequately anchorage lengths stirrup hooks longitudinal bars use cold joints frequently encountered workmanship defects Figs ',

'exponential relationships reported plots may used convert dielectric values air void values prescribed previous studies AC pavement composite permittivity reduces along reflection coefficient volumetric proportion air increases compared remaining components However method relies empirical fit determined case by case basis since permittivity remaining components depends mix design aggregate type binder content etc Long term studies Finland concluded empirical fit exponential relationship exponential fits using sufficient amount cores used map air void content variation similar manner dielectric maps shown Fig cores feasible due various factors involved testing final lift in service pavement cores needed stable exponential coefficients although limited cores show predicted relationships similar measured dielectric range case study Since regressions predict air void content maximum difference within uncertainty core measurement precision use either initial repeat run regression predictions appropriate ',

'MicroCT applied parts various forms preliminary results demonstrating visualization defects including porosity components reported another study porosity structures parts built improper settings investigated work average porosity ranged large pores observed followed build direction may attributed electron beam raster overlap pattern followed recent reports porosity distribution function build strategy electron beam melted samples average porosity another study similar porosity images microCT reported levels average porosity recent work reports similar images may indicate porosity structure depends build direction applications use microCT characterize parts include comparison part design model characterization surface roughness parts present work aim demonstrate specific type defect present low average porosity levels follow build direction reported examples also demonstrate porosity structure changes Hot Isostatic Pressing HIP treatment sample ',

'Aeroengine turbine disks often consist paramagnetic means non ferromagnetic Nickel based alloys Sometimes parasitic small ferromagnetic particles included disks may decrease mechanical stability reason case suspicion disks analysed respect ferromagnetic inclusions inclusions generate magnetic density measured flux gate magnetometer using magnetic remanence method detection principle ferromagnetic impurities non magnetic metallic materials based remanence measurement carried aeroengine turbine disks premagnetised axial direction ferromagnetic materials show well known hysteresis behaviour materials magnetised strong magnetic field drives magnetic material saturation removing magnetic field remanence left remaining flux density used detect non magnetic materials ',

'Although presented model developed tested a C H layers mind necessarily limited Moreover assumptions chemical reactions gas solid forming volatiles loss volatiles material two stated boundary conditions gas influx single outer surface possibility reactions throughout bulk Porosity significant gas inventories observed carbon e g also beryllium co deposits expected co deposits formed plasma devices Thus TCR description presented model may applicable deposits layer constituents forming volatiles reactive gas e g W O constituents removed TCR removed deposit influence removal deposit constituents time evolution process change new understanding TCR may first time allow applying method controlled way nuclear fusion devices possibly solving tritium retention issue especially related carbon based materials ',

'Power particle exhaust crucial viability future fusion power plant concept Heat fusion reactors must extract wall exhausted volumetrically limits allowed power density fusion reactors severe technical challenge addition structural material changes resulting neutron irradiation cause degradation heat exhaust capabilities existing designs static surfaces suffer severely erosion due impinging plasma particles concluded conventional concepts materials plasma facing components PFCs reach limits terms material lifetime power exhaust approximately MW m presumably dramatically reduced MW m due neutron damage D T reactor even half value ',

'main drawback thermo oxidation actual devices ITER limitation maintenance periods vessel walls heated around C hot helium injection cooling system also required reconditioning walls plasma operation remove absorbed oxygen However temperature achieved homogeneous vessel limited distance cooling tubes thus device design analysis study continuation previous works done treatment ITER carbon co deposits temperatures studied range C divertor C main wall remote parts present due budget restrains well due tritium trapped co deposited carbon layers ITER use carbon materials divertor strike points spite excellent resilience large heat loads Nevertheless many present experimental nuclear fusion devices DIII D TCV etc new ones JT SA KSTAR Wendstein X use carbon elements removal carbon co deposits still necessary better device operation plasma density control dust events etc temperatures used work different ones achievable present devices results extrapolated Moreover even ITER study could use useful carbon materials eventually installed case operation tungsten tiles strike points precluded unexpected reasons ']

In [26]:

```
cv=CountVectorizer(max_df=0.85)
word_count_vector=cv.fit_transform(docs)
```

In [27]:

```
print(f'word count vector shape:{word_count_vector.shape}')
```

word count vector shape:(493, 9179)

In [28]:

```
print(word_count_vector[0,:])
```

```
(0, 1455) 2
(0, 4471) 2
(0, 1260) 2
(0, 2462) 1
(0, 6399) 1
(0, 441) 1
(0, 1253) 1
(0, 7412) 2
(0, 6287) 2
(0, 5478) 2
(0, 7449) 1
(0, 4497) 1
(0, 3077) 2
(0, 8181) 3
(0, 862) 1
(0, 8905) 1
(0, 7455) 2
(0, 6814) 1
(0, 3928) 1
(0, 7129) 1
(0, 6650) 3
(0, 9041) 1
(0, 5476) 1
(0, 7774) 1
(0, 6954) 4
: :
(0, 6281) 1
(0, 2321) 2
(0, 1457) 1
(0, 1543) 1
(0, 7585) 1
(0, 2514) 1
(0, 7127) 1
(0, 6297) 1
(0, 1265) 1
```

```
(0, 1517) 1
(0, 7889) 1
(0, 4661) 1
(0, 5623) 1
(0, 9045) 1
(0, 8659) 1
(0, 3930) 1
(0, 6651) 1
(0, 288) 1
(0, 4533) 1
(0, 6340) 1
(0, 5411) 1
(0, 3374) 2
(0, 3916) 1
(0, 7485) 1
(0, 1694) 1
```

In [30]:

```
##Vocab
list(cv.vocabulary_.keys())[1000:1010]
```

Out[30]:

```
['catalysts',
 'enantiomer',
 'incorporate',
 'selector',
 'chemically',
 'distinguishable',
 'diastereomeric',
 'key',
 'requirement',
 'aiming']
```

## IDF Computation

In [31]:

```
tfidf_transformer=TfidfTransformer(smooth_idf=True,use_idf=True)
tfidf_transformer.fit(word_count_vector)
```

Out[31]:

```
▼ TfidfTransformer
TfidfTransformer()
```

In [32]:

```
tfidf_transformer.idf_
```

Out[32]:

```
array([5.81624116, 6.50938834, 6.50938834, ..., 6.50938834, 6.50938834,
        6.50938834])
```

In [33]:

```
tfidf_transformer.idf_.shape
```

Out[33]:

```
(9179,)
```

## Getting Keywords

In [34]:

```
def sort_coo(coo_matrix):
```

```
tuples = zip(coo_matrix.col, coo_matrix.data)
return sorted(tuples, key=lambda x: (x[1], x[0]), reverse=True)
```

In [35]:

```
def extract_topn_from_vector(feature_names, sorted_items, topn=10):
    sorted_items = sorted_items[:topn]

    score_vals = []
    feature_vals = []

    for idx, score in sorted_items:
        fname = feature_names[idx]

        score_vals.append(round(score, 3))
        feature_vals.append(feature_names[idx])

    results= {}
    for idx in range(len(feature_vals)):
        results[feature_vals[idx]]=score_vals[idx]

    return results
```

In [51]:

```
feature_names=list(cv.vocabulary_.keys())
feature_names
```

Out[51]:

```
['complex',
 'langevin',
 'cl',
 'dynamics',
 'provides',
 'approach',
 'circumvent',
 'sign',
 'problem',
 'numerical',
 'simulations',
 'lattice',
 'field',
 'theories',
 'boltzmann',
 'weight',
 'since',
 'rely',
 'importance',
 'sampling',
 'recent',
 'years',
 'number',
 'stimulating',
 'results',
 'obtained',
 'context',
 'nonzero',
 'chemical',
 'potential',
 'lower',
 'four',
 'dimensional',
 'severe',
 'thermodynamic',
 'limit',
 'two',
 'reviews',
 'see',
 'refs',
 'however',
 'known',
```

'shortly',  
'inception',  
'correct',  
'guaranteed',  
'calls',  
'improved',  
'understanding',  
'relying',  
'combination',  
'analytical',  
'insight',  
'past',  
'important',  
'role',  
'played',  
'properties',  
'real',  
'positive',  
'probability',  
'distribution',  
'complexified',  
'configuration',  
'space',  
'effectively',  
'sampled',  
'process',  
'clarified',  
'conclusion',  
'sufficiently',  
'localised',  
'order',  
'yield',  
'valid',  
'importantly',  
'recently',  
'also',  
'led',  
'promising',  
'nonabelian',  
'gauge',  
'implementation',  
'sl',  
'cooling',  
'nuclear',  
'theory',  
'devoted',  
'major',  
'efforts',  
'decades',  
'describe',  
'thermalization',  
'reactions',  
'predominantly',  
'using',  
'semi',  
'classical',  
'methods',  
'line',  
'similar',  
'problems',  
'quantum',  
'liquids',  
'attempts',  
'develop',  
'molecular',  
'combining',  
'features',  
'treatment',  
'dynamical',  
'correlations',  
'still',  
'clear',



'cut',  
'readily',  
'available',  
'yet',  
'spite',  
'numerous',  
'formal',  
'clusters',  
'nano',  
'structures',  
'far',  
'younger',  
'fast',  
'developing',  
'relation',  
'ongoing',  
'developments',  
'lasers',  
'imaging',  
'techniques',  
'semiclassical',  
'approaches',  
'considered',  
'include',  
'corrections',  
'could',  
'qualitatively',  
'processes',  
'bound',  
'simple',  
'metals',  
'delocalized',  
'wave',  
'functions',  
'thus',  
'smooth',  
'potentials',  
'justifying',  
'approximations',  
'case',  
'organic',  
'systems',  
'particular',  
'much',  
'celebrated',  
'treated',  
'way',  
'even',  
'used',  
'high',  
'excitations',  
'delivered',  
'intense',  
'laser',  
'pulses',  
'cases',  
'system',  
'blown',  
'details',  
'mechanical',  
'matter',  
'anymore',  
'less',  
'violent',  
'scenarios',  
'shell',  
'effects',  
'ignored',  
'next',  
'step',  
'might',  
'derivation',

'dirac',  
'equation',  
'creutz',  
'model',  
'suggests',  
'consider',  
'incorporating',  
'logical',  
'inference',  
'additional',  
'knowledge',  
'one',  
'objects',  
'hopping',  
'instead',  
'particles',  
'moving',  
'time',  
'continuum',  
'recall',  
'section',  
'description',  
'measurement',  
'scenario',  
'robustness',  
'etc',  
'explicitly',  
'discrete',  
'taken',  
'aim',  
'derive',  
'pauli',  
'formulated',  
'course',  
'motion',  
'particle',  
'entirely',  
'within',  
'fundamental',  
'obstacle',  
'replace',  
'proper',  
'therefore',  
'seems',  
'plausible',  
'extended',  
'massless',  
'spin',  
'considering',  
'corresponding',  
'in',  
'depth',  
'general',  
'beyond',  
'scope',  
'present',  
'paper',  
'leave',  
'interesting',  
'future',  
'research',  
'work',  
'shows',  
'based',  
'statistical',  
'mechanics',  
'nonlinear',  
'pdes',  
'us',  
'novel',  
'powerful',  
'tool',

'tackle',  
'phase',  
'transitions',  
'method',  
'leads',  
'solution',  
'perhaps',  
'test',  
'exhibits',  
'first',  
'transition',  
'heuristically',  
'described',  
'van',  
'der',  
'waals',  
'global',  
'mean',  
'partition',  
'function',  
'eq',  
'finite',  
'klein',  
'gordon',  
'reproduces',  
'isotherms',  
'away',  
'critical',  
'region',  
'automatically',  
'encodes',  
'maxwell',  
'equal',  
'areas',  
'rule',  
'hereby',  
'presented',  
'remarkable',  
'simplicity',  
'successfully',  
'applied',  
'macroscopic',  
'larger',  
'class',  
'models',  
'admitting',  
'form',  
'extend',  
'equations',  
'state',  
'including',  
'virial',  
'expansions',  
'fluctuating',  
'vacuum',  
'feature',  
'fields',  
'free',  
'example',  
'fermionic',  
'describing',  
'electron',  
'undergo',  
'fluctuations',  
'consequently',  
'expects',  
'find',  
'casimir',  
'associated',  
'whenever',  
'confined',  
'investigated',

'physics',  
'so',  
'called',  
'mit',  
'bag',  
'nucleon',  
'envisages',  
'collection',  
'quarks',  
'subject',  
'boundary',  
'condition',  
'surface',  
'represents',  
'electromagnetic',  
'modifies',  
'appearance',  
'force',  
'although',  
'weak',  
'scale',  
'significant',  
'small',  
'length',  
'scales',  
'encountered',  
'consequences',  
'use',  
'open',  
'close',  
'aperture',  
'scan',  
'experiments',  
'analogy',  
'saturation',  
'absorption',  
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'series',  
'primary',  
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'nm',  
'femtosecond',  
'inclusion',  
'optical',  
'chopper',  
'vibrational',  
'states',  
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'couplings',  
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'relaxation',  
'non',  
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'rise',  
'transient',  
'thermal',  
'related',  
'pure',  
'nonlinearity',  
'samples',  
'measured',  
'change',  
'values',  
'individual',

'accumulate',  
'repetition',  
'rate',  
'produce',  
'cumulative',  
'effect',  
'longer',  
'timescales',  
'mode',  
'mismatched',  
'color',  
'pump',  
'probe',  
'experiment',  
'spectrally',  
'resolved',  
'three',  
'pulse',  
'photon',  
'echo',  
'measurements',  
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'ni',  
'co',  
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'freedom',  
'scans',  
'delays',  
'allows',  
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'varying',  
'population',  
'times',  
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'broadening',  
'revealed',  
'spectra',  
'integrated',  
'show',  
'different',  
'electronic',  
'timescale',  
'found',  
'sub',  
'fs',  
'whereas',  
'intramolecular',  
'occurring',  
'band',  
'picosecond',  
'liquid',  
'nature',  
'structure',  
'remains',  
'topic',  
'keen',  
'debate',  
'active',  
'area',

'centers',  
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'whether',  
'mainly',  
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'distorted',  
'hydrogen',  
'bonds',  
'contains',  
'mixture',  
'distinct',  
'components',  
'development',  
'application',  
'inner',  
'ray',  
'spectroscopy',  
'xas',  
'emission',  
'xes',  
'oxygen',  
'edge',  
'investigate',  
'provide',  
'direct',  
'structural',  
'providing',  
'bonding',  
'network',  
'theoretical',  
'studies',  
'play',  
'analysis',  
'experimental',  
'data',  
'requires',  
'calculations',  
'link',  
'observed',  
'underlying',  
'simulation',  
'presents',  
'difficult',  
'challenge',  
'accurate',  
'excitation',  
'energies',  
'intensities',  
'furthermore',  
'adequate',  
'configurations',  
'needs',  
'accounted',  
'conditions',  
'occur',  
'induces',  
'resulting',  
'ionization',  
'decay',  
'explain',  
'above',  
'mentioned',  
'fragmentation',  
'dcpd',  
'cpd',  
'shown',  
'figure',  
'fitting',  
'transients',  
'done',  
'matlab',  
'programming',

'curve',  
'levenberg',  
'marquardt',  
'algorithm',  
'best',  
'fit',  
'constants',  
'biexponential',  
'ion',  
'signal',  
'conform',  
'previously',  
'reported',  
'norbornene',  
'norbornadiene',  
'reaction',  
'fragment',  
'parent',  
'indicating',  
'neutrals',  
'applying',  
'control',  
'principles',  
'circumstances',  
'confirms',  
'controlling',  
'product',  
'photochemical',  
'carbon',  
'atoms',  
'graphene',  
'empowered',  
'progress',  
'aberration',  
'corrected',  
'transmission',  
'microscopy',  
'ac',  
'tem',  
'capable',  
'ångstrom',  
'resolution',  
'examples',  
'observations',  
'formation',  
'annealing',  
'stone',  
'wales',  
'defects',  
'reconstruction',  
'large',  
'hole',  
'sheet',  
'single',  
'vacancy',  
'defect',  
'exploited',  
'visualization',  
'self',  
'assembly',  
'nanoribbons',  
'precursors',  
'nanometre',  
'size',  
'hollow',  
'protrusion',  
'nanotube',  
'sidewall',  
'transformation',  
'flake',  
'fullerene',  
'new',

'top',  
'down',  
'mechanism',  
'beam',  
'radiation',  
'proposed',  
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'knock',  
'on',  
'damage',  
'electrons',  
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'reduces',  
'dangling',  
'triggers',  
'curving',  
'closed',  
'dynamic',  
'behaviour',  
'plays',  
'crucial',  
'explaining',  
'mechanisms',  
'assisted',  
'transformations',  
'like',  
'rp',  
're',  
'encounter',  
'finds',  
'improve',  
'performance',  
'devices',  
'to',  
'implement',  
'scheme',  
'highly',  
'enhances',  
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'orders',  
'magnitude',  
'basic',  
'idea',  
'behind',  
'magnetic',  
'amount',  
'singlet',  
'products',  
'reverse',  
'reasoning',  
'estimate',  
'intuitively',  
'intensity',  
'produces',  
'formally',  
'defined',  
' $\lambda$ s',  
' $\phi$ s',  
'pre',  
'gs',  
'dt',  
'instantaneous',  
'functional',  
'spel',  
'strongly',  
'depends',  
'realization',



'radical',  
'pair',  
'surrounding',  
'spins',  
'devoid',  
'hyperfine',  
'interactions',  
'second',  
'interacts',  
'isotropically',  
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'nitrogen',  
'compass',  
'task',  
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'picture',  
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'yeb',  
'ye',  
'αs',  
'isotropic',  
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'employed',  
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'verify',  
'validity',  
'purposes',  
'tests',  
'exchange',  
'adiabatic',  
'running',  
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'lowest',  
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'starting',  
'upper',  
'sheets',  
'take',  
'place',  
'amounts',  
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'probable',

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'studied',  
'due',  
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'character',  
'noted',  
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'justified',  
'masses',  
'involved',  
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'semiconductor',  
'photophysics',  
'injection',  
'electric',  
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'materials',  
'polarizes',  
'surroundings',  
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'polaron',  
'light',  
'fluorescence',  
'quenching',  
'polarons',  
'issues',  
'operation',  
'optoelectronic',  
'particularly',  
'relevant',  
'electrically',  
'pumped',  
'advances',  
'design',  
'lasing',  
'threshold',  
'pumping',  
'low',  
'enough',  
'enable',  
'inorganic',  
'diodes',  
'leds',  
'fabrication',  
'sensitive',  
'cost',  
'biosensing',  
'chemosensing',  
'injected',  
'charges',  
'quench',  
'luminescence',  
'accept',  
'excitons',  
'resonant',  
'dipole',  
'loss',  
'well',  
'cross',  
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'quantifying',  
'density',  
'film',  
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'unipolar',

'contacting',  
'electrodes',  
'dependent',  
'mobility',  
'densities',  
'compared',  
'capacitance',  
'voltage',  
'differed',  
'factor',  
'letter',  
'revisit',  
'chesnavich',  
'tst',  
'barrierless',  
'molecule',  
'concepts',  
'ots',  
'tts',  
'clearly',  
'terms',  
'geometrical',  
'goal',  
'article',  
'identification',  
'notions',  
'dividing',  
'attached',  
'nhims',  
'main',  
'elucidation',  
'roaming',  
'phenomenon',  
'possessing',  
'many',  
'realistic',  
'reveal',  
'origins',  
'dss',  
'periodic',  
'orbit',  
'pods',  
'natural',  
'framework',  
'influenced',  
'environment',  
'local',  
'spontaneous',  
'rates',  
'nanostructured',  
'photonic',  
'familiar',  
'summarized',  
'resonance',  
'similarly',  
'chromophores',  
'biological',  
'contain',  
'organizations',  
'bands',  
'shifted',  
'influence',  
'nearby',  
'centres',  
'instance',  
'widely',  
'harvesting',  
'complexes',  
'identifiable',  
'forms',  
'photosynthetic',  
'antenna',

'bacteriochlorophyll',  
'centred',  
'efficient',  
'occurs',  
'neighbouring',  
'carotenoid',  
'species',  
'broader',  
'off',  
'mostly',  
'induced',  
'circular',  
'dichroism',  
'electrodynamic',  
'qed',  
'procedures',  
'predict',  
'chiral',  
'mediator',  
'confers',  
'capacity',  
'achiral',  
'acceptor',  
'exhibit',  
'differential',  
'range',  
'temperatures',  
'chosen',  
'alanine',  
'dipeptide',  
'relatively',  
'physically',  
'minima',  
'seven',  
'characterised',  
'solvent',  
'spacing',  
'minimum',  
'higher',  
'indeed',  
'overs',  
'approximate',  
'becomes',  
'harmonic',  
'approximation',  
'prediction',  
'crossover',  
'temperature',  
'kbt<sub>xo</sub>',  
'ln',  
'illustrates',  
'balance',  
'entropy',  
'receptors',  
'human',  
'biology',  
'consist',  
'drug',  
'action',  
'involves',  
'specified',  
'enantiomeric',  
'spurred',  
'especially',  
'pharmaceutical',  
'industry',  
'host',  
'secure',  
'enantiopure',  
'multi',  
'consuming',  
'typically',

```
'cast',
'categories',
'synthetic',
'designed',
'stereoisomer',
'separation',
'isolate',
'enantiotomers',
'racemic',
'drawback',
'either',
'dependence',
'supply',
'reagents',
'substrates',
'synthesis',
'routes',
'generally',
'utilise',
'building',
'blocks',
'enantioselective',
...]
```

In [52]:

```
doc_test = docs[1]
```

In [53]:

```
doc_test
```

Out[53]:

'Nuclear theory devoted major efforts since decades describe thermalization nuclear reactions predominantly using semi classical methods line similar problems quantum liquids attempts develop improved molecular dynamics methods combining quantum features semi classical treatment dynamical correlations Still clear cut quantum approach readily available yet spite numerous formal attempts field clusters nano structures far younger fast developing relation ongoing developments lasers imaging techniques Semiclassical approaches also considered field include dynamical corrections could qualitatively describe dynamical processes approaches bound simple metals sufficiently delocalized wave functions thus smooth potentials justifying semiclassical approximations case organic systems particular much celebrated C treated way Semi classical even classical approaches used high excitations delivered intense laser pulses cases system blown details quantum mechanical features matter anymore less violent scenarios quantum shell effects ignored '

In [54]:

```
tf_idf_vector=tfidf_transformer.transform(cv.transform([doc_test]))
```

In [55]:

```
sorted_items=sort_coo(tf_idf_vector.tocoo())
```

In [56]:

```
sorted_items
```

Out[56]:

```
[(6513, 0.32713077649916295),
 (1272, 0.27399858004102146),
 (7285, 0.23187554453304682),
 (2460, 0.22381338901724654),
 (7286, 0.20943197802654592),
 (442, 0.1803407542133742),
 (584, 0.16482957375106436),
 (2079, 0.14057784511105864),
 (3028, 0.1322824942176238),
 (5468, 0.1269077238737569),
 (9055, 0.10471598901327296),
```

(4361, 0.10471598901327296),  
(2019, 0.10471598901327296),  
(1116, 0.10471598901327296),  
(846, 0.10471598901327296),  
(410, 0.10471598901327296),  
(3077, 0.09843265235645533),  
(8758, 0.09819330552748254),  
(7650, 0.09819330552748254),  
(6498, 0.09819330552748254),  
(4629, 0.09819330552748254),  
(2016, 0.09819330552748254),  
(454, 0.09819330552748254),  
(4957, 0.0936926514795513),  
(8193, 0.09356538794440257),  
(6213, 0.09356538794440257),  
(4144, 0.09356538794440257),  
(3206, 0.09356538794440257),  
(2846, 0.09356538794440257),  
(2138, 0.09356538794440257),  
(4483, 0.08997569618545215),  
(3871, 0.08997569618545215),  
(2128, 0.08997569618545215),  
(1868, 0.08997569618545215),  
(1728, 0.08997569618545215),  
(6433, 0.08704270445861215),  
(5569, 0.08704270445861215),  
(2126, 0.08704270445861215),  
(1948, 0.08704270445861215),  
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(6619, 0.08456289528754929),  
(9043, 0.08241478687553218),  
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(3889, 0.08241478687553218),  
(2523, 0.08241478687553218),  
(1403, 0.08241478687553218),  
(7179, 0.08052002097282172),  
(5480, 0.08052002097282172),  
(1720, 0.08052002097282172),  
(1313, 0.08052002097282172),  
(8397, 0.07882509511658176),  
(5265, 0.07882509511658176),  
(5630, 0.07729184817768227),  
(7889, 0.07589210338974176),  
(4482, 0.07589210338974176),  
(1283, 0.07589210338974176),  
(882, 0.07460446300574884),  
(4607, 0.0734122942186789),  
(2123, 0.0734122942186789),  
(2102, 0.0734122942186789),  
(6790, 0.07230241163079133),  
(6160, 0.07230241163079133),  
(8399, 0.0712641858066618),  
(4851, 0.0712641858066618),  
(3007, 0.0712641858066618),  
(4774, 0.06849964501025536),  
(3003, 0.06849964501025536),  
(3941, 0.06767449404771136),  
(1072, 0.06767449404771136),  
(6609, 0.06688961073288847),  
(4556, 0.06688961073288847),  
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(3961, 0.06474150232087138),  
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(7435, 0.06408480228876094),  
(5207, 0.06345386193687845),  
(7771, 0.06284673641816094),  
(7430, 0.062261693149808506),  
(4891, 0.062261693149808506),  
(3320, 0.062261693149808506),  
(8873, 0.061697182005321816),  
(2462, 0.061697182005321816),

```
(8096, 0.06115181056192094),
(8883, 0.0601135847377914),
(625, 0.059618563623021474),
(8183, 0.059138321486658936),
(6300, 0.059138321486658936),
(2805, 0.059138321486658936),
(5786, 0.058218818835080954),
(2516, 0.05652389297884097),
(6290, 0.054990646039941506),
(8245, 0.05427555423096221),
(1595, 0.053929585695491146),
(1746, 0.05230326086800807),
(8041, 0.051111092080938114),
(7455, 0.047521400321987685),
(1071, 0.047521400321987685),
(441, 0.04578057738221765),
(8037, 0.04312495316209182),
(3688, 0.042273594889600155),
(8633, 0.03671926595100739),
(288, 0.0366022696763014),
(8625, 0.03392385407073638)]
```

In [57]:

```
top_n=10
keywords=extract_topn_from_vector(feature_names,sorted_items,top_n)
```

In [62]:

```
keywords
```

Out[62]:

```
{'ve': 0.327,
 'oxide': 0.274,
 'asn': 0.232,
 'wf': 0.224,
 'suitably': 0.209,
 'temporal': 0.18,
 'tem': 0.165,
 'requisites': 0.141,
 'uo': 0.132,
 'late': 0.127}
```

In [60]:

```
print("\n====Body====")
print(doc_test)
print("\n===Keywords===")
for k in keywords:
    print(k,keywords[k])
```

====Body====

Nuclear theory devoted major efforts since decades describe thermalization nuclear reactions predominantly using semi classical methods line similar problems quantum liquids attempts develop improved molecular dynamics methods combining quantum features semi classical treatment dynamical correlations Still clear cut quantum approach readily available yet spite numerous formal attempts field clusters nano structures far younger fast developing relation ongoing developments lasers imaging techniques Semiclassical approaches also considered field include dynamical corrections could qualitatively describe dynamical processes approaches bound simple metals sufficiently delocalized wave functions thus smooth potentials justifying semiclassical approximations case organic systems particular much celebrated C treated way Semi classical even classical approaches used high excitations delivered intense laser pulses cases system blown details quantum mechanical features matter anymore less violent scenarios quantum shell effects ignored

===Keywords===

```
ve 0.327
oxide 0.274
asn 0.232
wf 0.224
suitably 0.209
. 0.18
tem 0.165
```

temporal 0.18  
tem 0.165  
requisites 0.141  
uo 0.132  
late 0.127

Function to apply for the entire dataset

In [64]:

```
def extract_keywords_tfidf(doc):  
    tf_idf_vector=tfidf_transformer.transform(cv.transform([doc]))  
    sorted_items=sort_coo(tf_idf_vector.tocoo())  
    keywords=extract_topn_from_vector(feature_names,sorted_items,10)  
    keywords = list(keywords)  
    return keywords
```

In [65]:

```
extract_keywords_tfidf(doc_test)
```

Out[65]:

['ve',  
'oxide',  
'asη',  
'ωf',  
'suitably',  
'temporal',  
'tem',  
'requisites',  
'uo',  
'late']

In [66]:

```
data['extracted_keywords'] = data['input'].apply(extract_keywords_tfidf)
```

In [67]:

```
data
```

Out[67]:

	input	keywords	extracted_keywords
0	Complex Langevin CL dynamics provides approach...	[CL, complexified configuration space, Complex...	[codebook, sstps, compressible, fegsem, macrom...
1	Nuclear theory devoted major efforts since dec...	[C60, combining quantum features, field of clu...	[ve, oxide, asη, ωf, suitably, temporal, tem, ...
2	next important step might derivation Dirac equ...	[continuum space-time, Dirac equation, future ...	[detail, emotion, cfl, superior, myocardial, s...
3	work shows approach based combination Statisti...	[class virial expansions, field partition func...	[pyrrolidine, grammar, intervening, nmr, clini...
4	fluctuating vacuum general feature quantum fie...	[a collection of fermionic fields describing c...	[orders, casting, fracture, supplier, abelian,...
...	...	...	...
488	MicroCT applied parts various forms preliminar...	[AM parts, average porosity, build direction, ...	[drag, machining, temperature, technical, dama...
489	Aeroengine turbine disks often consist paramag...	[Aeroengine turbine disks, decrease the mechan...	[columns, whole, wilkins, equilibrated, ioccg,...
490	Although presented model developed tested a C ...	[a-C:H layers, beryllium co-deposits, carbon, ...	[megalopolis, marsh, multiples, percentage, wo...
491	Power particle exhaust crucial viability futur...	[D-T reactor, fusion power plant, fusion react...	[broken, families, tortuosity, encapsulation, ...
...	...	...	...



493 rows x 3 columns

### Enhancement using N-Gram

In [71]:

```
cv=CountVectorizer(ngram_range=(1,2)) #enable unigram and bigram
word_count_vector=cv.fit_transform(docs)
print(word_count_vector.shape)
list(cv.vocabulary_.keys())[-15:]
```

(493, 52423)

Out[71]:

```
['even iter',
 'iter study',
 'study could',
 'could useful',
 'useful carbon',
 'materials eventually',
 'eventually installed',
 'installed case',
 'case operation',
 'operation tungsten',
 'tungsten tiles',
 'tiles strike',
 'points precluded',
 'precluded unexpected',
 'unexpected reasons']
```

In [72]:

```
tfidf_transformer.fit(word_count_vector)
```

Out[72]:

▼ TfidfTransformer

TfidfTransformer()

In [86]:

```
feature_names=list(cv.vocabulary_.keys())
```

In [87]:

```
def extract_keywords_tfidf(doc):
    tf_idf_vector=tfidf_transformer.transform(cv.transform([doc]))
    sorted_items=sort_coo(tf_idf_vector.tocoo())
    keywords=extract_topn_from_vector(feature_names,sorted_items,10)
    keywords = list(keywords)
    return keywords
```

In [89]:

```
extract_keywords_tfidf(docs[99])
```

Out[89]:

```
['effectively generating',
 'lewy cfl',
 'minimum stages',
 'controller design',
 'symbolic meaning',
 'temperature cpa',
 'growth two',
 'quality teaching',
```

```
'difference discretization',  
'particles function']
```

In [90]:

```
data['extracted_key_pharse'] = data['input'].apply(extract_keywords_tfidf)
```

In [92]:

```
data.head()
```

Out[92]:

	input	keywords	extracted_keywords	extracted_key_pharse
0	Complex Langevin CL dynamics provides approach...	[CL, complexified configuration space, Complex...	[codebook, sstps, compressible, fegsem, macrom...	[current trends, paper features, reduced mitig...
1	Nuclear theory devoted major efforts since dec...	[C60, combining quantum features, field of clu...	[ve, oxide, asη, ωf, suitably, temporal, tem, ...	[neglected fact, access thermodynamic, potenti...
2	next important step might derivation Dirac equ...	[continuum space-time, Dirac equation, future ...	[detail, emotion, cfl, superior, myocardial, s...	[directly multi, experiment results, capital l...
3	work shows approach based combination Statisti...	[class virial expansions, field partition func...	[pyrrolidine, grammar, intervening, nmr, clini...	[resonances, theses, galilean, theoretical har...
4	fluctuating vacuum general feature quantum fie...	[a collection of fermionic fields describing c...	[orders, casting, fracture, supplier, abelian,...	[dataset comprised, even state, potential valu...