PreProcessCAE.py

- **get_pre_processing_data(str, bool)** -> tuple

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- create_nodes_dataframe(str) -> pd.DataFrame
- create_elements_dataframe(str) -> pd.DataFrame
- create_materials_dataframe(str) -> pd.DataFrame
- create_properties_dataframe(str) -> pd.DataFrame
- create_loads_dataframe(str) -> pd.DataFrame
- create_boundary_conditions_dataframe(str) -> pd.DataFrame

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- print_dataframe_configuration(pd.DataFrame, str) -> None
- fix_scientific_notation(str) -> str

main.py

- INPUT_FILE_NAME
- OUTPUT_FILE_NAME

- get_pre_processing_input()
- assemble_global_stiffness_matrix()
- assemble_global_load_vector()
- impose_boundary_conditions_penalty_method()
- get_post_processing_output()

PostProcessCAE.py

- **get_post_processing_output**(np.array, np.array, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame) -> pd.DataFrame
- create_displacement_dataframe(np.array, pd.DataFrame, pd.DataFraeme) -> pd.DataFrame
- create_forces_dataframe(np.array, pd.DataFrame, pd.DataFrame) -> pd.DataFrame
- create_stress_dataframe(np.array, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame) -> pd.DataFrame
- create_strain_dataframe(np.array, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame) -> pd.DataFrame
- compute_element_stress(FiniteElement, np.array) -> tuple
- compute_element_strain(FiniteElement, np.array, pd.DataFrame, tuple) -> np.array
- compute_von_mises_stress(np.array) -> float

SolverCAE.py

- **solve_system**(np.array, np.array, np.array) -> tuple
- **assemble_global_stiffness_matrix**(pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame) -> np.array
- **assemble_global_load_vector**(str, pd.DataFrame, pd.DataFrame) -> np.array

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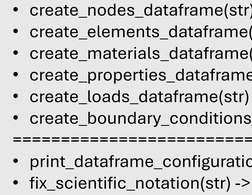
- **impose_boundary_conditions_penalty_method**(str, pd.DataFrame, pd.DataFrame, np.array, np.array) -> tuple
- get_boundary_condition_dofs(str, pd.DataFrame, pd.DataFrame) -> np.array
- set_fixed_boundary_conditions(np.array, np.array, np.array) -> tuple

class FiniteElement

- __init__(*self*, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- get_node_coordinates(*self*, pd.DataFrame) -> np.array
- get_global_index_dofs(*self*, pd.DataFrame) -> np.array

1D Elements

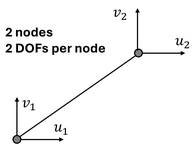
- **2 nodes**
- **6 DOFs per node**



class CBAR

- __init__(*self*, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- **assemble_stiffness_matrix(*self*) -> np.array**
- compute_local_stiffness_matrix_cbar(*self*) -> np.array
- compute_transformation_matrix(*self*) -> np.array

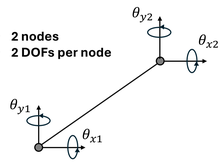
- **2 nodes**
- **2 DOFs per node**



class Beam_Axial

- __init__(*self*, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- **assemble_stiffness_matrix(*self*) -> np.array**
- compute_local_stiffness_matrix_cbar(*self*) -> np.array
- compute_transformation_matrix(*self*) -> np.array

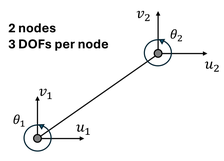
- **2 nodes**
- **2 DOFs per node**



class Beam_Torsional

- __init__(*self*, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- **assemble_stiffness_matrix(*self*) -> np.array**
- compute_local_stiffness_matrix_cbar(*self*) -> np.array
- compute_transformation_matrix(*self*) -> np.array

- **2 nodes**
- **3 DOFs per node**



class Beam_Flexural

- __init__(*self*, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- **assemble_stiffness_matrix(*self*) -> np.array**
- compute_local_stiffness_matrix_cbar(*self*) -> np.array
- compute_transformation_matrix(*self*) -> np.array

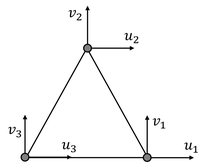
2D Elements

class Element2D(FiniteElement)

- __init__(self, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- assemble_jacobian_matrix(*self*, float, float) -> np.array
- assemble_B_matrix(*self*, float, float) -> np.array
- assemble_D_matrix(*self*, str) -> np.array
- assemble_G_matrix(*self*, np.array, float) -> np.array
- assemble_P_matrix(*self*, np.array, np.array) -> np.array

class CTRIA3(Element2D)

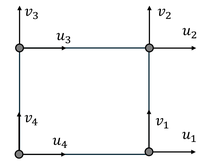
- __init__(self, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- **assemble_stiffness_matrix**(*self*) -> np.array
- compute_quadrature(*self*) -> tuple
- compute_shape_functions(*self*, float, float) -> np.array
- compute_shape_functions_derivatives(*self*, float, float) -> tuple



- **3 nodes**
- **2 DOFs per node**

class CQUAD4(Element2D)

- __init__(self, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- **assemble_stiffness_matrix**(*self*) -> np.array
- compute_quadrature(*self*) -> tuple
- compute_shape_functions(*self*, float, float) -> np.array
- compute_shape_functions_derivatives(*self*, float, float) -> tuple



- **4 nodes**
- **2 DOFs per node**

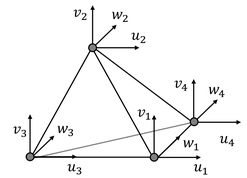
3D Elements

Class Element3D(FiniteElement)

- __init__(self, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- *assemble_jacobian_matrix*(*self*, float, float, float) -> np.array
- assemble_B_matrix(*self*, float, float, float) -> np.array
- assemble_D_matrix(*self*) -> np.array
- assemble_G_matrix(*self*, np.array) -> np.array
- assemble_P_matrix(*self*, np.array, np.array, np.array) -> np.array

class CTETRA

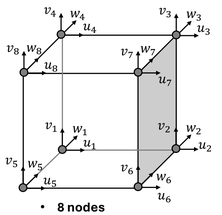
- __init__(self, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- **assemble_stiffness_matrix**(*self*) -> np.array
- quadrature(*self*) -> tuple
- compute_shape_functions(*self*, float, float, float) -> np.array
- compute_shape_functions_derivatives(*self*, float, float, float) -> tuple



- **4 nodes**
- **3 DOFs per node**

class CHEXA

- __init__(self, pd.DataFrame, pd.DataFrame, pd.DataFrame, pd.DataFrame)
- **assemble_stiffness_matrix**(*self*) -> np.array
- quadrature(*self*) -> tuple
- compute_shape_functions(*self*, float, float, float) -> np.array
- compute_shape_functions_derivatives(*self*, float, float, float) -> tuple



- **8 nodes**
- **3 DOFs per node**