VG100: INTRODUCTION TO ENGINEERING

Course Introduction

Dr. Qiang Zhang

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Preview

- Who's who
- About Engineering
- About VG 100 & Project
- Course Schedule & Grading
- Honor Code & Discipline Policy
- Safety
- Tips for Surviving or Thriving

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Who's who

Name	Day and Time	Location
Prof. Qiang Zhang	By appointment, "Open Door Policy"	528 Long Bing Lou
Prof. Irene Wei	Tue 14:00-15:30 or by appointment	435A Long Bing Lou
Technical TAs • **Ziying Huang** • **Yuhao Wang** • **Weihan Fan**	TBD	E-reading room
Communication TAs • **Xingye Tang** • **Minjia Qian**	TBD	E-reading room

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Qiang Zhang (張強)

- **Education**:
  - Ph.D. Mech. Eng., University of Utah
- **Previous Work Experience:**
  - Academic:
    - Associate Professor (Tenured), UM-SJTU Joint Institute, SJTU
    - Lecturer, City University of London, UK
    - Research Staff, University of Oxford, UK
    - Research Assistant Professor, University of Utah, USA
  - Industrial:
    - WIKA instrumentation Co.
    - Petro-Chem / John Zink combustion company
    - Robot and Intelligence Technology R&D Center, Beijing
- **Research:**
  - Thermal management
  - Aerocraft engine aerothermodynamics

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YOU !	by appointment?	

The instructors will also want to learn from you!
You will be rewarded for challenging me / asking questions I hadn't previously thought of.

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Engineering is NOT about

- Acquisition of specific practical skills
  - Cutting teeth of gear wheel
  - Training people to run existing computational codes (AI,CFD…)

❖ Everybody can take your job if the entry requirement is low!

Engineering is about

- Planning / Imagining
- Designing
- Understanding / predicting, as **quantitatively** as possible, **why** and **how** an engineering objective can be realised and delivered.

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Engineering is about

Curiosity ➔ Invention

Leonardo Da Vinci

Leonardo's Notebooks

"An object offers as much resistance to the air as the air does to the object. You may see that the beating of its wings against the air supports a heavy eagle in the highest and rarest atmosphere, close to the sphere of elemental fire. Again you may see the air in motion over the sea, fill the swelling sails and drive heavily laden ships. From these instances, and the reasons given, a man with wings large enough and duly connected might learn to overcome the resistance of the air, and by conquering it, succeed in subjugating it and rising above it"

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Engineering is about

Concept → Reality

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Engineering is about

Good understanding → New invention

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Engineering is about

Achieve engineering objectives within realistic constraints

Still one of the most successful aerodynamic designs!

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Engineering is about

Provide professional service to the society

Shall the government kill off all the coal-fired plant?

Shall we built some nuclear power plants near Shanghai?

Is electrical car/airplane truly green?

Is one particular engineering innovation truly make people's lives better?

- Engineers should be able to offer an informed view whereas other members of society are much less likely to be able to adopt a rationally justified position.

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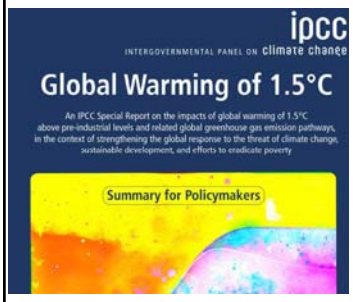
Engineering is about

Provide professional service to the society



more than 6,000 scientific references cited and the dedicated contribution of thousands of expert and government reviewers worldwide…

October 8, 2018

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Engineers' Creed

As a Professional Engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare.

I pledge:

To give the utmost of performance;

To participate in none but honest enterprise;

To live and work according to the laws of man and the highest standards of professional conduct;

To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations.

In humility and with need for Divine Guidance, I make this pledge.
(Adopted June 1954)

NSPE 75 The National Society of Professional Engineers 75th Anniversary

National Society of Professional Engineers®

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Engineering…

Involves people	*We…*
Uses dreaming	*… who have goals*
Involves argumentation	*…who don't agree with everything*
Involves teamwork	*……who recognize that we can't do it alone*
Involves technology	*… who need things to accomplish those goals*
Involves scientific reasoning	*…who use science and math to consider those things*
Requires abilities to reason and to argue in quantitative terms	*… to communicate accurately and precisely how things work and why some things are better than others*
Involves ability to translate ideas into things	*…so that things can be made*
Seeks to enhance things	*…and improved upon*

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What Vg 100 is about

- **Project-based learning**
  - Introduces some engineering fundamentals
  - Designs and builds an engineering system from concept to reality
  - Identifies and solves practical problems & challenges
  - Requires technical communication
  - Covers ethics
  - Embraces group dynamics and human interaction
  - **Encourages curiosity and exploration**

…It's about gaining experience as well as knowledge

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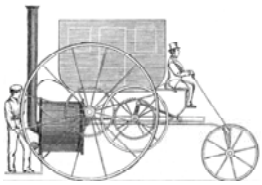
The project in our section is about……

The first reliable steam engine in **1775** (James Watt)



London Steam Carriage, 1803
The world's first self-propelled passenger-carrying vehicle.

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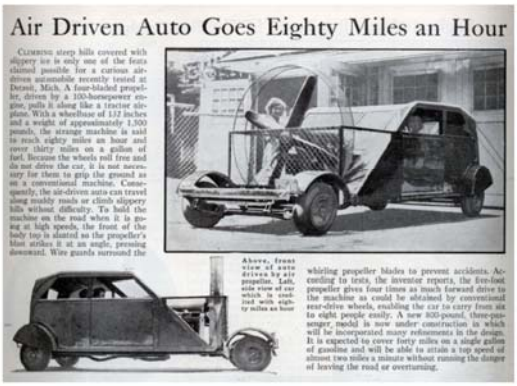
Air Driven Auto Goes Eighty Miles an Hour (Dec, 1932)



Air Driven Auto Goes Eighty Miles an Hour

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The project in our section is about……

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The project in our section is about……

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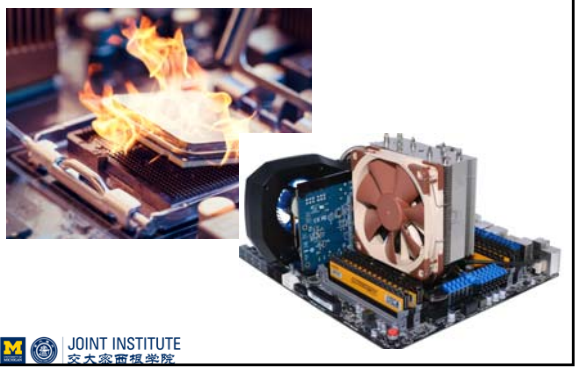
The project in our section is about……



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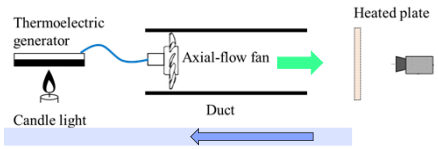
The project in our section



- **Knowledge (have a taste):**
  - VM235 & 336 Thermodynamics
  - VM250 Design and Manufacturing
  - VM320 & 420 Fluid Mechanics
  - VM 335 Heat Transfer
  - VM432 Combustion
  - VM 421 Thermo-Fluids Systems Design

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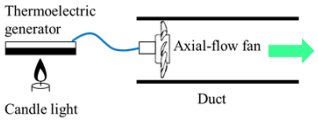
The project in our section



- **Key activities**
  - Concept ➔ detailed design ➔ build (within 8 weeks)
  - Performance measurement
  - Technical report & presentation
  - Identify follow-up topics by your own

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May Schedule Weeks 1-3

WK	DAY	Date	Prof/TA	Tentative Lecture Topics (T = Technical; C = Communication; D&P = Discussion and Presentation)	HW	Due
1	TUE	May 14	Zhang	T1: Course introduction		
	THU	May 16	Wei	C1: Technical Communication: Audience & Context		
	TBD	May		No Lab		
	TBD	May				
2	TUE	May 21	Zhang	T2: Energy & Energy Conversion		
	THU	May 23	Wei	C2: Engineering Ethics, Professional Codes, Citation, Intellectual Property Rights	Assign TC HW#1	
	TBD	May	TAs	Lab 1: Lab orientation; Introduction to project and overall structure design		
	TBD	May				
3	TUE	May 28	Zhang	T3: Combustion & Fluid Mechanics		
	THU	May 30	Zhang	T4: Aerodynamics & fan blade design		
	TBD	May	TAs	Lab 2: Supporting structure assembly and thermoelectric system performance testing (with dummy fan)		
	TBD	May				

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June Schedule Weeks 4-7

4	TU	June 4	Wei	C3: Project management & the process of technical writing: Interim report		TC HW #1 due
	THU	Jun 6	Wei	C4: Characteristics of a Technical document: Interim report		
	TBD	Jun	TAs	Lab 3: Preliminary performance test & 2D fan blade design		
	TBD	Jun				
5	TUE	Jun 11	Zhang	T5: Dimensional Analysis		
	THU	Jun 13	Wei	C5: Using Style and Design	Assign TC HW #2	
	TBD	Jun	TAs	Lab 4: 2D fan blade assembly & testing		
	TBD	Jun				
6	MON	Jun 17	Zhang	T6: Engineering Measurement		
	TUE	Jun 18	Zhang	T7: Experimental Uncertainty		
	THU	Jun 20	Wei	Meet with groups		TC HW #2 due
	TBD	Jun	TAs	Lab 5: 3D blade testing & performance measurement		
	TBD	Jun				
7	MON	Jun 24	Zhang	T8: Introduction to Heat Transfer		
	TUE	Jun 25	Wei	C7: Pitch and Proposal		
	THU	Jun 27	Zhang + Wei	**In-class Exam**		
	TBD	Jun	TAs	Lab 6: Performance measurement & follow up project planning		
	TBD	Jun				

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June Schedule Weeks 8-10

8	Mon	July 1	Zhang	T9: Thermal management		
	TUE	July 2	Zhang	T10: Project management		
	THU	July 4	Wei	C8: Symposium presentation & Exhibit poster	Assign TC HW #3	
	TBD	July	TAs	Lab 7: Overall Cooling Performance tests & follow up project planning (assessment)		
	TBD	July				
9	MON	July 8	Wei	C9: Team Presentation Skills	Assign TC HW #4	**Interim Report due**
	TUE	July 9	Zhang	T11: HAVC		
	THU	July 11	Zhang	T12: TBD		**Proposal due**
	TBD	July	TAs	Lab 8: Follow-up project		
	TBD	July				
10	MON	July 15	Zhang	T12: TBD		
	TUE	July 16	Wei	C10: practice presentation		TC HW #3, 4 due
	THU	July 18	Wei	C10: practice presentation		
	TBD	July	TAs	Lab 9: Follow-up project		
	TBD	July				

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June Schedule Weeks 11-13

11	MON	July 22	Zhang + Wei	D&P 3: Symposium practice presentation (10 minutes)		
	TUE	July 23	Zhang + Wei	D&P 4: Symposium practice presentation (10 minutes)		
	THU	July 25	Zhang + Wei	D&P 5: Symposium practice presentation (10 minutes)		
	TBD	July	TAs	Lab 10: Follow-up project		
	TBD	July				
	SUN July 28		**All**	**Symposium Day 9:30am-4:00pm**		
12	TUE	July 30	Wei	C12: Final Report & wrap up		
	THU	Aug 1	Zhang	T13: Wrap up		
	MON	July 29	TAs	Lab 11: Final Performance Measurement & Get Ready for Expo		
	TBD	Aug				
13	TBD	Aug				**Final Report due**
	WED	**Aug 7**		**Design Expo**		

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Industrial Visit

AECC Commercial Aircraft Engine Co., Ltd (AECC CAE)

Late May – June (approx. 2 hours)
We need fix the dates…

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Grading Policy

Category	Item	Max. Percent %	Distribution
Individual Work (30%)	In-class quizzes	7	100% Tech.
	Homework	8	100% TC
	Exam	15	60% Tech., 40% TC
Team Work (70%)	Peer Evaluation	Team Multiplier	N/A
	Core Project	**35**	
	· Completion and Performance	20	100% Tech.
	· Interim Report	15	60% Tech., 40% TC
	Follow-up Project	**35**	
	· Proposal	3	60% Tech.,40% TC
	· Expo demo + Poster	5	100% TC
	· Symposium	12	60% Tech., 40% TC
	· Final Report	15	60% Tech., 40% TC

Total VG100 Grade = Team Work × Team Multiplier + Individual Work

- The instructor is entitled to offer bonus point (up to 2%) for rewarding individual motivation, initiative and critical analysis.

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Course Grading

- **90%-100% A**
- **80%-90% B**
- **70%-80% C**

This *roughly* translates to per assignment grades

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Honor Code

- **Summary of ethical standards that bind *both* students and faculty**
- **Key principle: TRUST**

You may:

- **Co-author**
- **Use (limited) services of a proof reader**

You may not:

- **Hand in work not your own**
- **Omit citations**

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Discipline

Violations of the honor code will be turned over to the Honor Council

- **Sadly, it happens**
- **Penalties can be severe**

- **Late paper 10% day (starting on due date and including weekends)**
- **Missed work can result in a failing grade**

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Safety Rules

- In this class you will work on projects that can be dangerous if you are unaware of the specific hazards and neglect relevant precautions.
- The lab supervisor/manager, technicians, and teachers assistants will ensure that you know of specific hazards and use personal protection equipment (PPE). PPE is available and must be worn at all times in the lab and when working on projects outside the lab.
- If working in your dormitory you are responsible for the personal safety of yourself and anyone entering the living space, and you must provide and ensure the use of PPE for all inhabitants of the living space including yourself.

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Mechanical Engineering Lab Safety Guidelines

- No loud noises and yelling while others are working with the equipment.
- Do not work in the shop if you are impaired by drug or alcohol use, tired or in a hurry.
- Concentrate on your work. Distractions cause injury.
- Read and obey all operational signs and warnings.
- Do not operate equipment you are unfamiliar with. *The only stupid question is the one that goes unasked*. Seek help from shop staff. You may only operate equipment in which you have received proper training and obtained approval from the Lab supervisor.
- Do not use broken or dull tools. Report all broken tools and equipment to lab personnel.

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General Electrical Circuits Safety

- Do not work alone on energized electrical equipment.
- Power must be switched off whenever an experiment or project is being assembled or disassembled. Discharge any high voltage points to ground with a well-insulated jumper.
- Remember that capacitors can store dangerous quantities of energy.
- Make measurements in live circuits with well-insulated probes and one hand behind your back. Do not allow any part of your body to contact any part of the circuit or equipment connected to the circuit.
- Never touch electrical equipment while standing on a damp or metal floor.
- Never handle wet, damp or ungrounded electrical equipment.
- Wearing a ring or watch can be hazardous in an electrical laboratory since such items make good electrodes for the human body.
- Never lunge for a falling part of a live circuit such as leads or measuring instruments.

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General Electrical Circuits Safety

- Never touch two pieces of equipment simultaneously.
- Never touch even one wire of a circuit; it may be “hot” (i.e. capable of delivering an electric shock).
- Avoid heat dissipating surfaces of high wattage resistors and loads because they can cause severe burns.
- Some components (particularly large wattage resistors) have exposed metal that is electrically “hot.” Take extra care when working with these components.
- Ask the Teaching Assistants or instructor to check out your constructed circuit before applying power.
- Never short-circuit a power source.
- When using instruments connected to the power line, connect all ground leads to the same point. Otherwise, a short circuit may result.
- When using a voltmeter or ammeter, begin with the highest range and work your way down to a suitable range.
- When using an ohmmeter, never measure resistance in a live circuit.
- Keep instruments away from the edge of the work bench.

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Tips for Surviving (or even Thriving)

- **Communicate, communicate, communicate**
- **Cooperate, first; Compete, second**
- **Think "forest," not "trees"**
- **Develop effective relationships**

- **Be curious & motivated**
- **It is not about how nice your project will look, it is about how much you learn & understand!**
- **You will be rewarded for good questions or fixing "good mistakes"!**

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Review

- Who's who
- About Engineering
- About VG 100 & Project
- Course Schedule & Grading
- Honor Code & Discipline Policy
- Safety
- Tips for Surviving or Thriving

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You have it within your power of turning this class into an exceptional experience….

We…

… who have goals

… who don't agree with everything

……who recognize that we can't do it alone

… who need things to accomplish those goals

…who use science and math to consider those things

… to communicate accurately and precisely how things work and why some things are better than others

…so that things can be made

…and improved upon

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