

# **Dislocation Plasticity**

## **EGM 6934 Class 22805 Section 406H**

**Class Period:** Tuesday, Periods 2 and 3, 8:30 am – 10:25 pm (with 15 minute break)

**Class Period:** Thursday, Periods 2, 8:30 am – 9:20 am

**Location:** BEN 328

**Academic Term:** Spring 2019

### ***Instructor***

Douglas Spearot, Ph.D.

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Phone: 352-392-6747

Office Hours: Tuesday, 10:30 – 11:30 am, Thursday 9:30 – 10:30 am, NEB 133 (or by appointment)

### ***Teaching Assistants***

None. Contact Prof. Spearot for all questions related to course material.

### ***Course Description***

This course will be divided into two primary components. The first part will provide students with an overview of dislocation theory. This includes stress/displacement fields of straight and curved dislocations, dislocation core energies, interactions between dislocations, and relationships between dislocations and plastic slip. The second part will focus on the classical theory of plasticity and the relationship between dislocations and plastic strain hardening. This includes yield surfaces, plastic potentials, isotropic/kinematic hardening, and other recent developments in plasticity theory.

### ***Required Textbook***

No textbook will be formally required for this course. Recommended textbooks include:

Anderson, P.M., Hirth, J.P. and Lothe, J. (2017) *Theory of Dislocations*, 3<sup>rd</sup> Edition.

Khan, A. S., Huang, S. (1995) *Continuum Theory of Plasticity*.

Lubliner, J. (2008) *Plasticity Theory*.

### ***Proposed Course Topics***

- 1) Review of Historical Ideas related to Dislocations (3 lectures)
- 2) Theory of Straight and Curved Dislocations (12)
  - a) Stress and displacement fields for edge/screw/mixed dislocations
  - b) Image forces on dislocations and dislocation interactions
- 3) Influence of Lattice Periodicity (3)
  - a) Peierls-Nabarro dislocation model
  - b) Slip in FCC/BCC materials
- 4) Dislocation Motion (3)
- 5) Review of Simple Yield Criteria (3)
- 6) Classical Theory of Plasticity (9)
  - a) Plastic potential and plastic work
  - b) Isotropic / kinematic hardening models
  - c) Deformation theory of plasticity
- 7) Recent Plasticity / Damage Models (3)

### ***Assessment Methods***

Grades in this course will be determined based on your performance on homework assignments and course project(s) report/presentation:

### ***Homework 40%***

Homework will be assigned and collected approximately every two or three weeks. Some homework assignments will require programming skills in Matlab. No late homework assignments will be accepted without prior approval.

### ***Course Projects 60%***

Students will be required to complete critical literature reviews on a focused aspect of dislocations and plasticity. Students will present the results of their work via a written report and an oral presentation (during the regular class period). Example project topics include:

- Jog mechanisms for the movement of dislocations in crystalline materials
- Self-stress field of straight and curved dislocations
- New models for kinematic hardening in continuum plasticity

It is the responsibility of each student to propose project topics. Topics that are related to the student's area of research are acceptable and encouraged. However, students may not duplicate research results or research publication for credit in this class. Students are encouraged to speak with Professor Spearot prior to submitting project topics.

### ***Grading Scale***

An example numerical grading scheme is provided below. This information should only be used as a general guide as the course instructor reserves the right to adjust the final numerical grading demarcations. Course grades will be "curved" if necessary – this decision will not be made until the end of the semester once all exams and homework assignments are graded.

93–100 = A, 90–92.9 = A-, 87–89.9 = B+, 83–86.9 = B, 80–82.9 = B-, 77–79.9 = C+, 73–76.9 = C  
70–72.9 = C-, 67–69.9 = D+, 63–66.9 = D, 60–62.9, <60 = E

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

Class attendance is highly recommended, but is not mandatory. Excused absences for homework submission and exams must be consistent with university policies in the graduate catalog and require appropriate documentation (<http://gradcatalog.ufl.edu/>). Homework extensions will be provided for excused absences in which notification is provided before the assignment date.

### ***Students Requiring Accommodations***

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter, which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### ***Course Evaluation***

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at: <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at: <https://evaluations.ufl.edu/results/>.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code." On all work submitted for credit by students at the University of Florida, the following

pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor in this class.

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy regarding grades earned in courses and on individual assignments. For more information, please see:

<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

## *Campus Resources*

### Health and Wellness

#### **U Matter, We Care**

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352-392-1575 so that a team member can reach out to the student.

#### **Counseling and Wellness Center**

<http://www.counseling.ufl.edu/cwc> or 352-392-1575; or contact the University Police Department: 352-392-1111 or 9-1-1 for emergencies.

#### **Sexual Assault Recovery Services (SARS)**

Contact the Student Health Care Center at 352-392-1161.

#### **University Police Department**

Contact UFPD at 352-392-1111 (or 9-1-1 for emergencies) or <http://www.police.ufl.edu/>.

### Academic Resources

#### **E-Learning Technical Support**

Call 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu). You may also find answers to common problems at <https://lss.at.ufl.edu/help.shtml>.

#### **Career Resource Center**

Located in the Reitz Union and offers career assistance and counseling. Call 352-392-1601 or <https://www.crc.ufl.edu/>.

#### **Library Support**

Information on various ways to receive assistance using the libraries or finding resources. <http://cms.uflib.ufl.edu/ask>.

#### **Teaching Center**

Located in Broward Hall and provides general study skills and tutoring. Call 352-392-2010 or 352-392-6420 or <https://teachingcenter.ufl.edu/>.

#### **Writing Studio**

Located at 302 Tigert Hall. Provides help brainstorming, formatting, and writing papers. Call 352-846-1138 or <https://writing.ufl.edu/writing-studio/>.

#### **On-Campus Student Complaints**

[https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

#### **On-Line Students Complaints**

<http://www.distance.ufl.edu/student-complaint-process>.