Professor:	Paul Fieguth	pfieguth@uwaterloo.ca	E7-7428
TAs:	Ajar Sharma	ajar.sharma@uwaterloo.ca	DWE-2518C

Required Text:	P. Fieguth, *An Introduction to Complex Systems*, Springer, 2017
332 Home Page:	SYDE 332 Learn page

Class Times:	Tuesdays Thursdays 3:30-4:50	E7-4437
Tutorials:	Thursdays 5:00-5:50, every week	E7-4437

Office Hours:	Fieguth: Thursdays 2:30-3:20, E7-7428
	TA (Sharma): Tuesdays 2:30-3:20, DWE 2518C

Course Grading:

30% Four assignments, each with numerical/analytical and written components, exploring practical aspects of different parts of the course. These assignments are to be done individually. Assignments may be submitted up to 5 days late, but at -5% per day. (TurnItIn checking will be in place for assignments.)

10% A short in-class quiz, scheduled for Thursday, February 13th.

20% A modest project, a case study involving two or more of mathematics, earth science, monitoring / inverse problems, and policy. This project may be done individually, although preferably in groups of two, and will be due towards the end of the term.

40% Final exam
(Final exams with grades below 50% may be weighted more heavily in the course grade.)

Learning Objectives:

- Understand the assumptions and limitations behind linear dynamic / Gaussian systems

- Understand the mathematical properties of nonlinear dynamic / power-law systems

- Understand the meaning of bifurcations, hysteresis, limit cycles, heavy tails

- Be able to abstract / generalize the impacts and implications of nonlinear systems

- Be able to draw connections between macroscopic socio-environmental systems

Course Outline: (See home page for more detailed breakdown and additional information)

At a high level, we wish to better understand physical systems and their interactions with human society. This leads to four areas of discussion:

1. Mathematics and Modeling

2. The Science of the Physical World

3. Earth Monitoring and Inverse Systems

4. The Human World and Related Policy

In terms of content, the course will focus on Systems theory, Linear systems; Nonlinear dynamic systems; Spatial systems; Heavy-tailed or Power-law distributions; Complex systems, and Inverse problems.

Students should consult the course home page for on-line resources, a tutorial schedule, and other updates.

Cheating and Plagiarism: Students are expected to know what constitutes academic integrity. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71. Students are encouraged to discuss course material and concepts, however assignments must be undertaken individually.

The following text has been written by the University of Waterloo, not by the course instructor:

The following statements MUST be included in all course outlines and/or websites:

Academic Integrity:

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.

Check www.uwaterloo.ca/academicintegrity/ for more information.

Grievance:

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, www.adm.uwaterloo.ca/infosec/Policies/policy70.htm. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline:

A student is expected to know what constitutes academic integrity (www.uwaterloo.ca/academicintegrity/) to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean.

For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, www.adm.uwaterloo.ca/infosec/Policies/policy71.htm. For typical penalties check Guidelines for the Assessment of Penalties, www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm.

Appeals:

A decision made or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) www.adm.uwaterloo.ca/infosec/Policies/policy72.htm.

Note for Students with Disabilities:

Accessibility Services, located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.