

SIOC 216A Introduction to the Physics of Complex Systems

Winter Quarter, 2025

Tuesday/Thursday 1100AM-1220PM

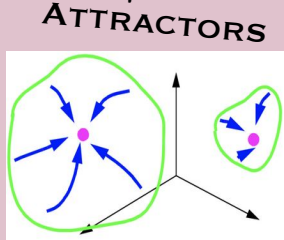
OAR 150 (@SIO campus - see website for directions)

COMPLEXITY

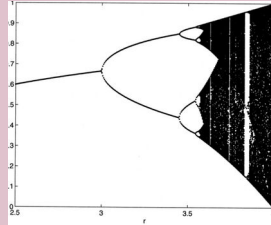
OPTIMIZATION



NONLINEARITY



ATTRACTORS



BIFURCATIONS

FEEDBACK

PATTERNS

SELF-ORGANIZATION

TIME SCALE

CHAOS

ASSEMBLAGE THEORY



DISSIPATION
SYSTEM
BOUNDARIES

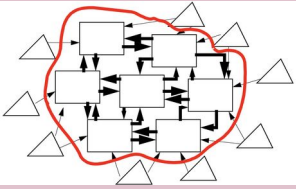


LINEAR STABILITY
ANALYSIS

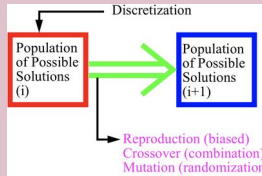
RESISTANCE
MOVEMENTS



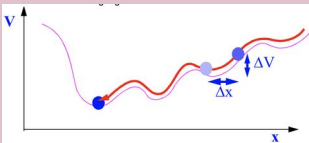
LEVEL OF
DESCRIPTION
BIPOC
STRUGGLES



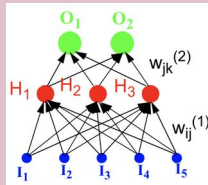
GENETIC
ALGORITHMS



CLIMATE CRISIS



SIMULATED
ANNEALING



NEURAL NETWORKS
POWER



COMPLEX ADAPTIVE
SYSTEMS



INJUSTICE



AGENT-BASED
MODELS

The study of complex systems is centrally focused on deciphering the ways in which the complicated interacts with the simple - the way a sand grain relates to a river, a tree relates to a forest, a worker relates to global capitalism, an indigenous clan relates to millennia of their culture, a resistance fighter relates to their resistance movement and the struggle against injustice.

In SIOC 216A, we will discuss the philosophical underpinnings of complexity and its implications, the conceptual and mathematical apparatus that has been developed (and continues to be developed) for analyzing complex systems, specific tools for probing different kinds of complex systems, modeling, measurement and data analysis strategies, and a framework for asking questions and answering them for any complex system.

Applications will include physical systems from canyons to climate, biological systems from flagella to forests, human systems from consciousness to culture, economic systems from stock markets to socialism, and political systems from colonialism to collectivism.

You will finish the course with a working knowledge of the concepts and methods used in the study of complex systems and how they have been and can be applied in the physical and social sciences.

In the last few weeks of the course in 2024, we will use the methods of complexity to analyze anti-Blackness and the struggles against it; unnatural disasters; the dynamics of injustice, centers of power and resistance movements; and the climate crisis.

For more information, contact bt werner bwerner@ucsd.edu

or check out <https://courses.complex-systems-laboratory.org/sioc216a>