KINETIC AND FLUID DYNAMIC MODELS FOR COMPLEX SUPPLY NETWORKS

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Collaborations

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- K. Kempf, J. Fowler (INTEL Corp.)
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Lecture 1: Introduction

- Introduction, some generic definitions.
- Model hierarchies: Discrete event simulation and multi agent models vs. rate equations and queueing theory.
- Rate equations (fluid models) and clearing functions.
- The problem with clearing functions. Non-equilibrium problems and conservation laws.
Lecture 2-3: Stochastic Fluctuations

- Traffic flow type models, differences and similarities between production systems and traffic flow.
- Stochasticity in the non-equilibrium regime.
- Deterministic first principle models + stochastic fluctuations.
- Mean field theories and long time averages.
- Ad hoc stochastic models from observed data. (system identification).
- The problem with stochastic fluctuations - hyperbolicity vs. diffusion.
Lecture 4: Policies

- The concept of priority scheduling. Level sets and policies for kinetic equations.
- Closures and conservation laws. Policies for stochastic systems.
- Examples.
Given a certain simulation model, optimize the system.

- Control parameters: Influx, routing, policies
- Cost functional: Deviation of deliveries from demand, production costs, etc.

Simulation model (conservation law) as constraint for optimizing a cost functional.

- Adjoint calculus.
- Mixed Integer Programming.

Examples.