

Supply Chain Visualization:

Simulation Engine
System Dynamics Model

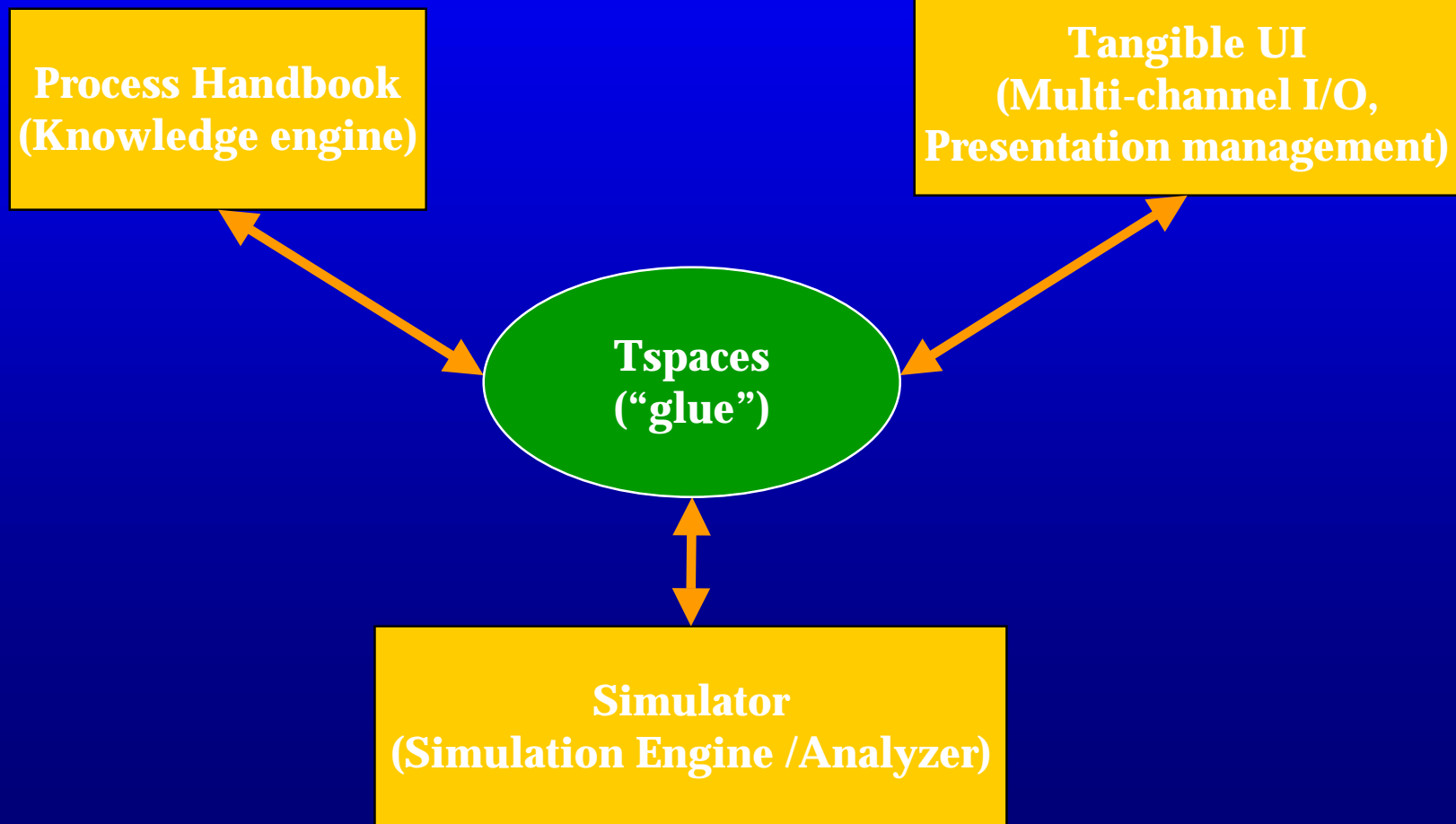
Three Separate Runtime Systems

**Process Handbook
(Knowledge engine)**

**Tangible UI
(Multi-channel I/O,
Presentation management)**

**Tspaces
("glue")**

**Simulator
(Simulation Engine /Analyzer)**



Simulator

- Simulation Engine
 - System Dynamics
 - Discrete Event
- System Dynamics Models of Intel
- Computer aided simulation analysis

SD Modeling Work

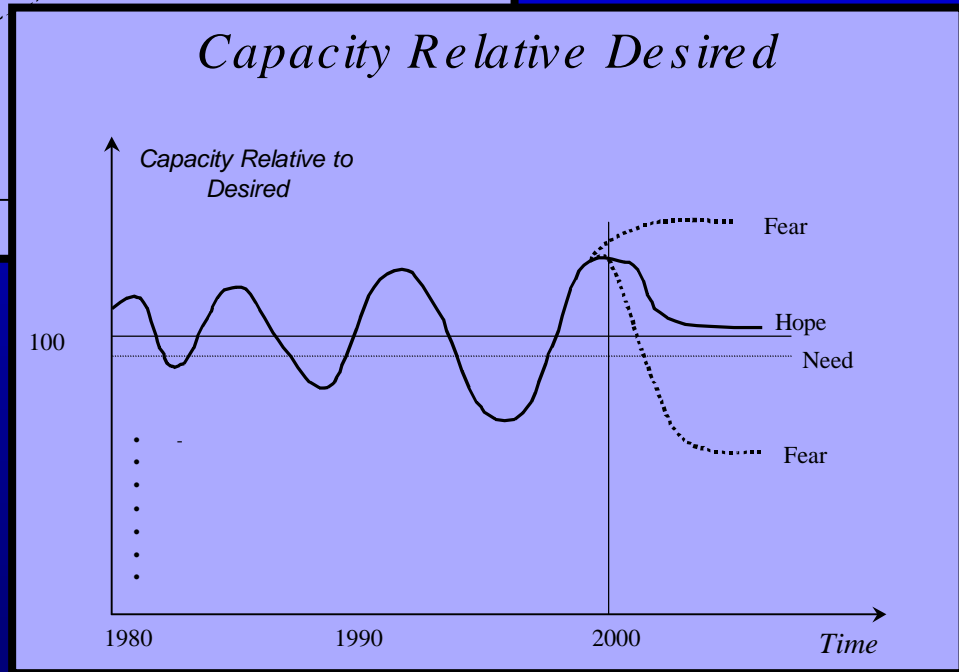
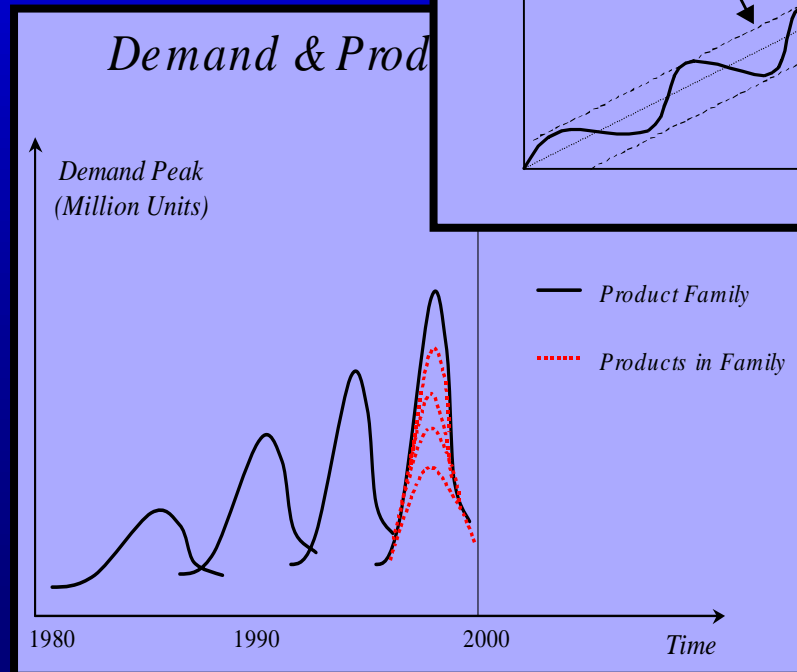
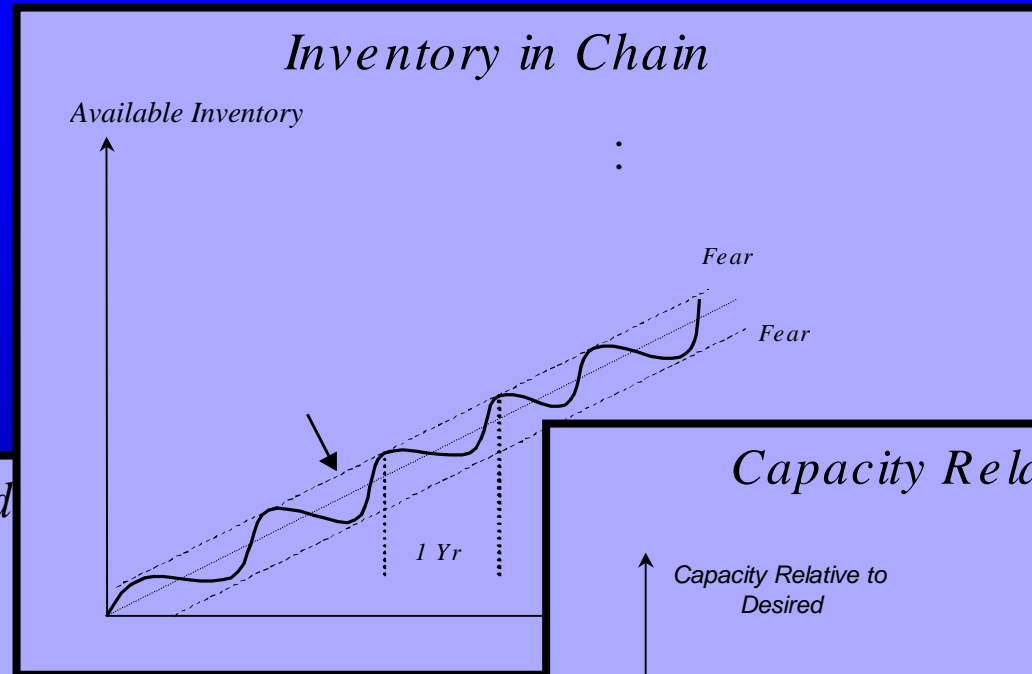
- System Dynamics focuses on
 - Understanding how a business can cause its own problems
 - Unstable production
 - Declining morale
 - Etc.
 - Understanding leverage points, where a small effort can have a large, beneficial effect

SD Requires Hands-on Knowledge

- Mary Murphy-Hoye
- Darren Blue
- George Brown
- David Fanger
- Tom Gardos
- Brian Kelly
- Karl Kempf
- Daniel Mckeon
- Gordon McMillan
- Gene Meieran
- Alison Page
- Dean Phillips
- Roberta Bailey Roberts
- Nick Rose
- Michael Waithe
- Ann Johnson

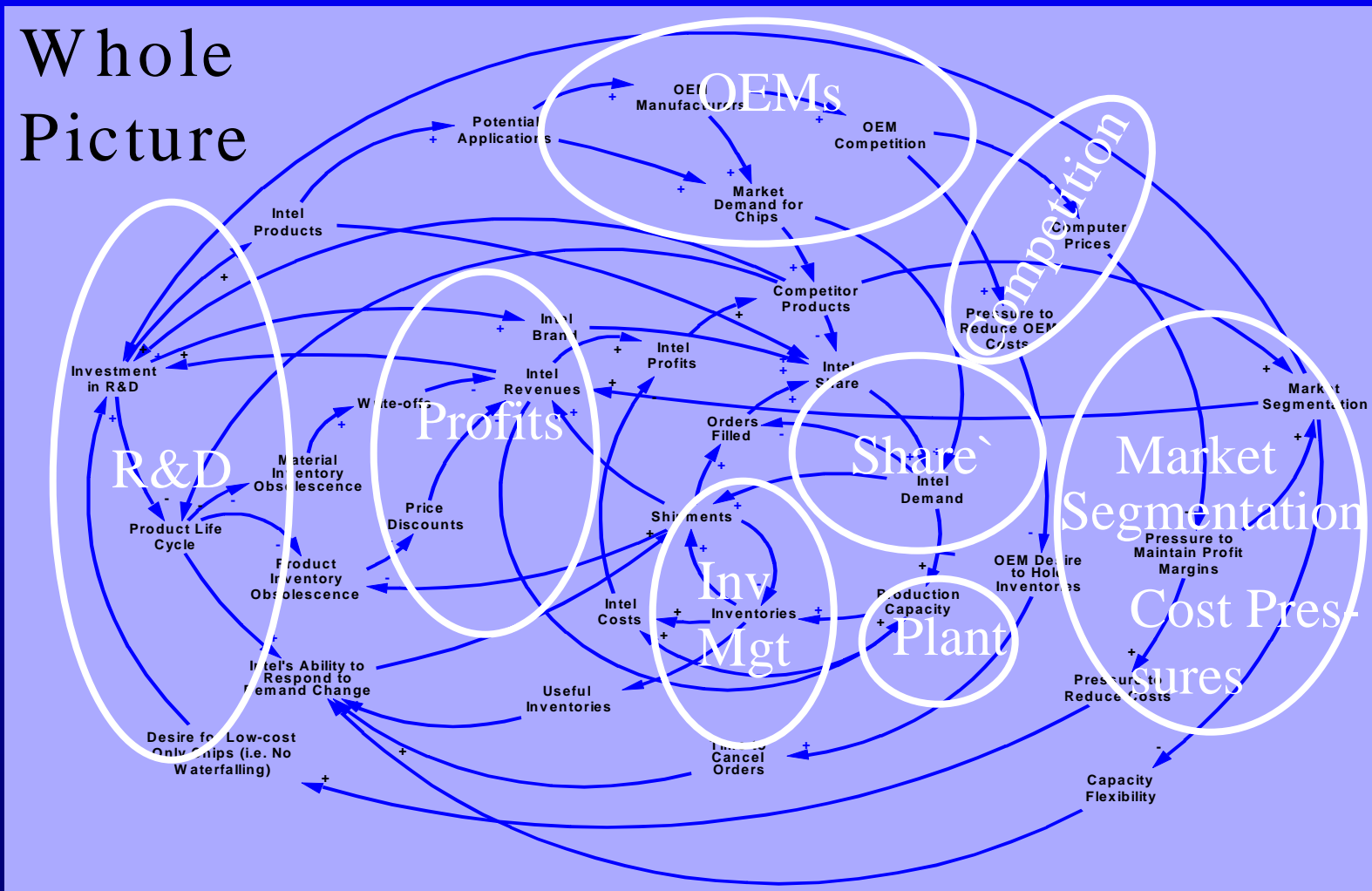
SD Focuses on Patterns

Reference Modes

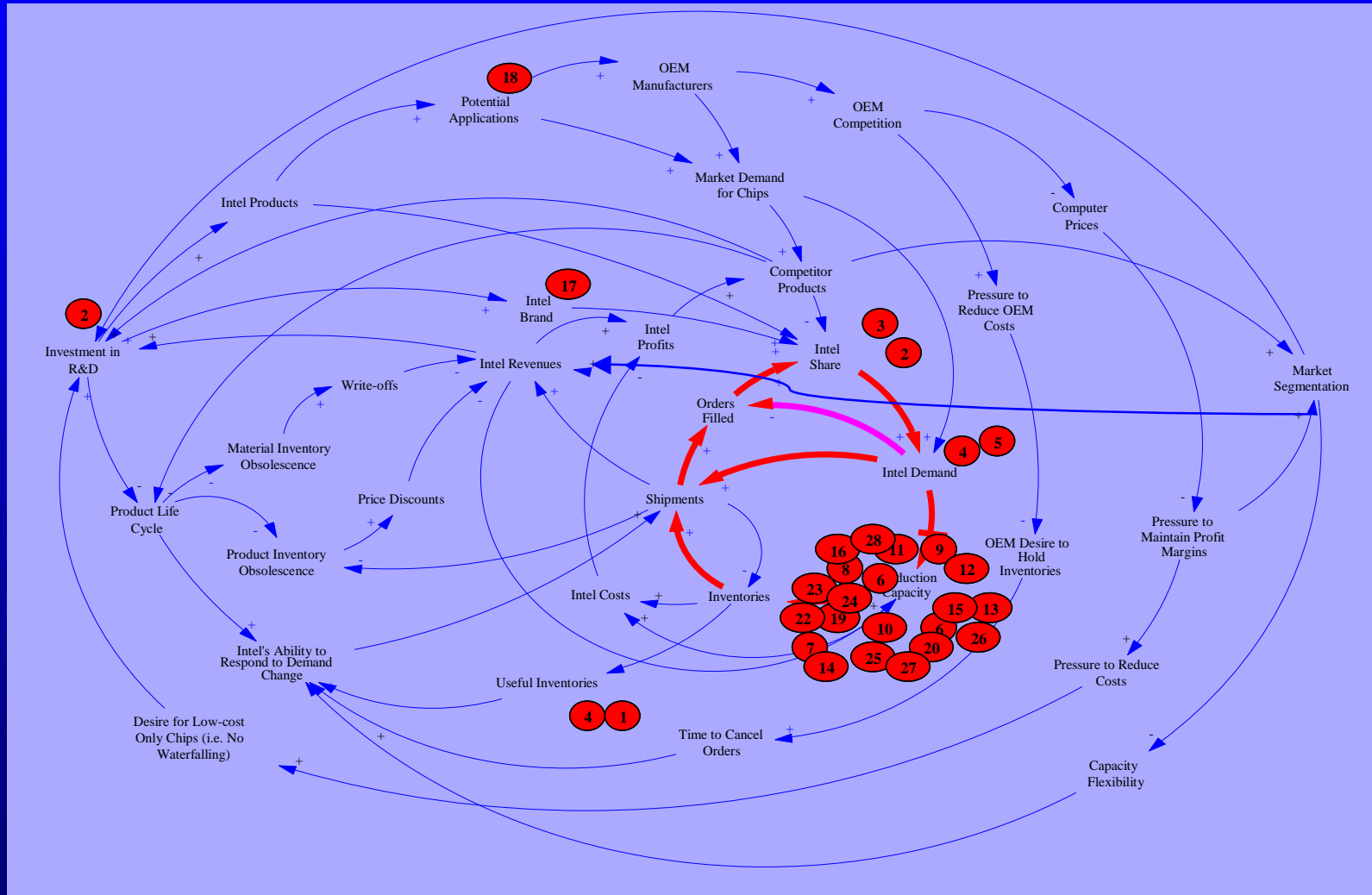


SD Focuses on Endogenous (internal) Causes

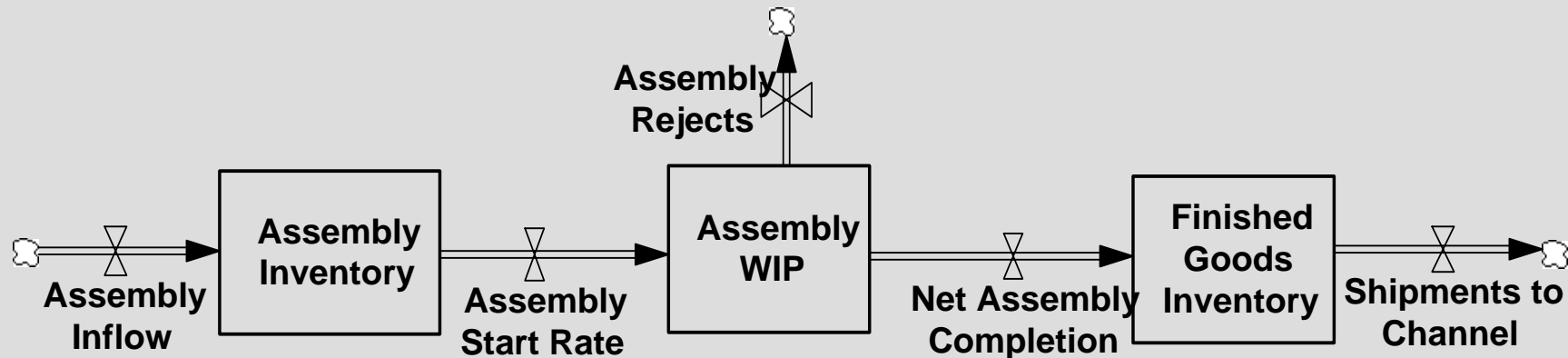
Feedback Loops



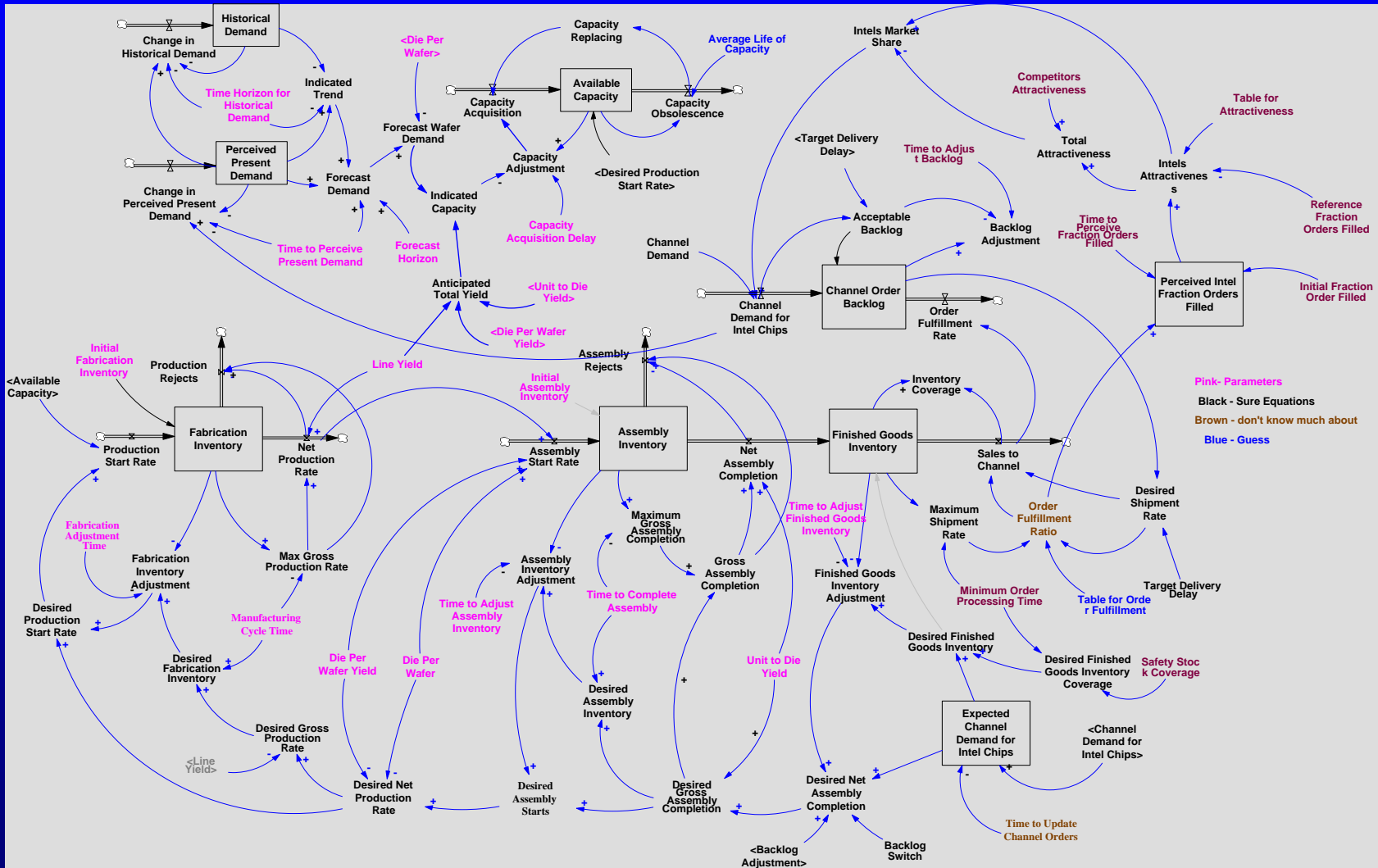
Current/Proposed Solutions



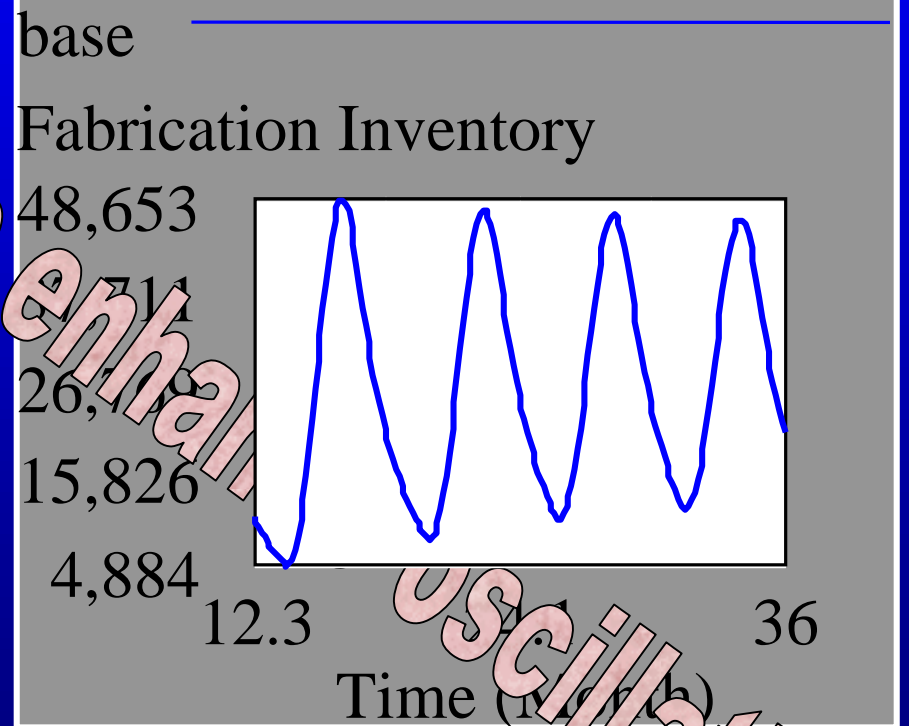
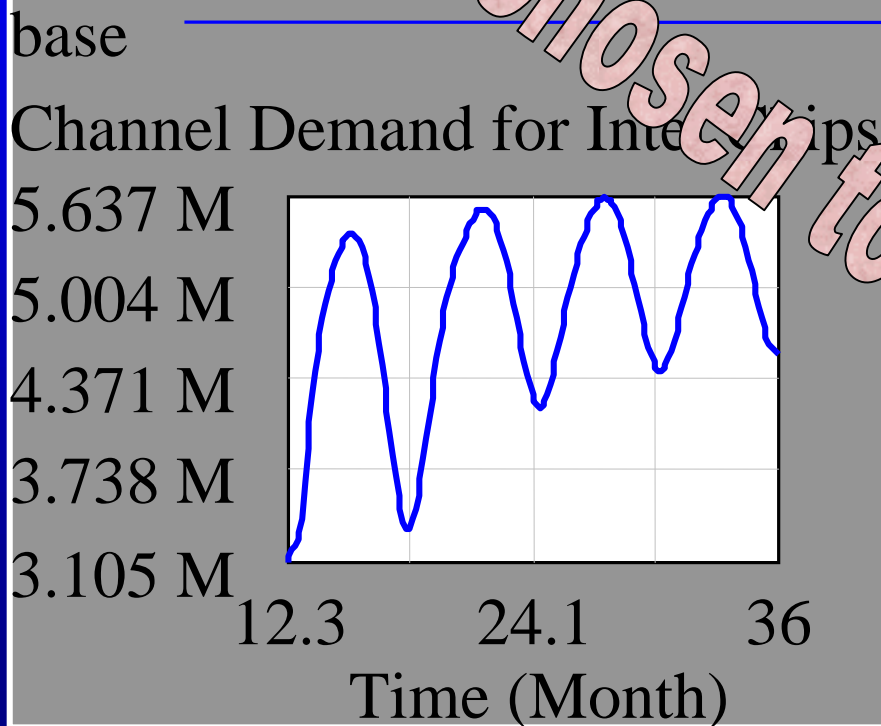
Model Detail



Simulation Model



Model Behavior (output)



Parameters chosen to enhance

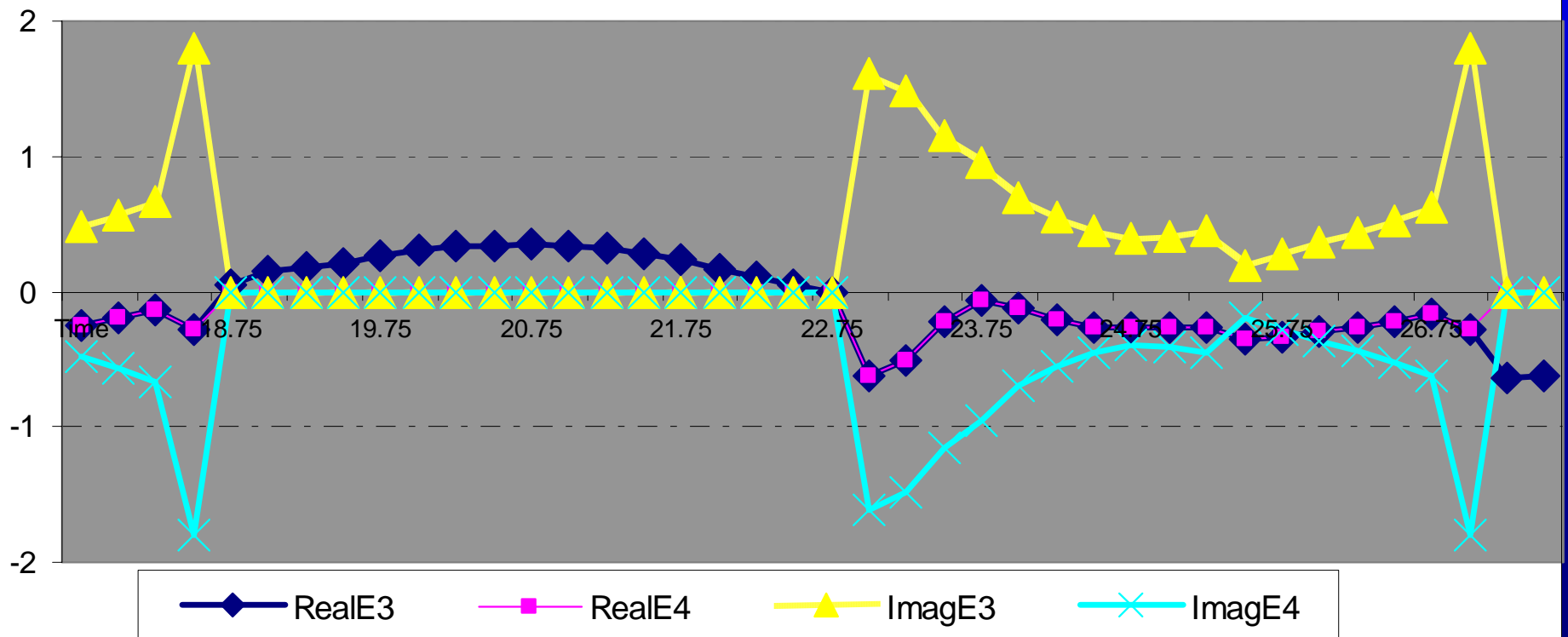
oscillations

BUT

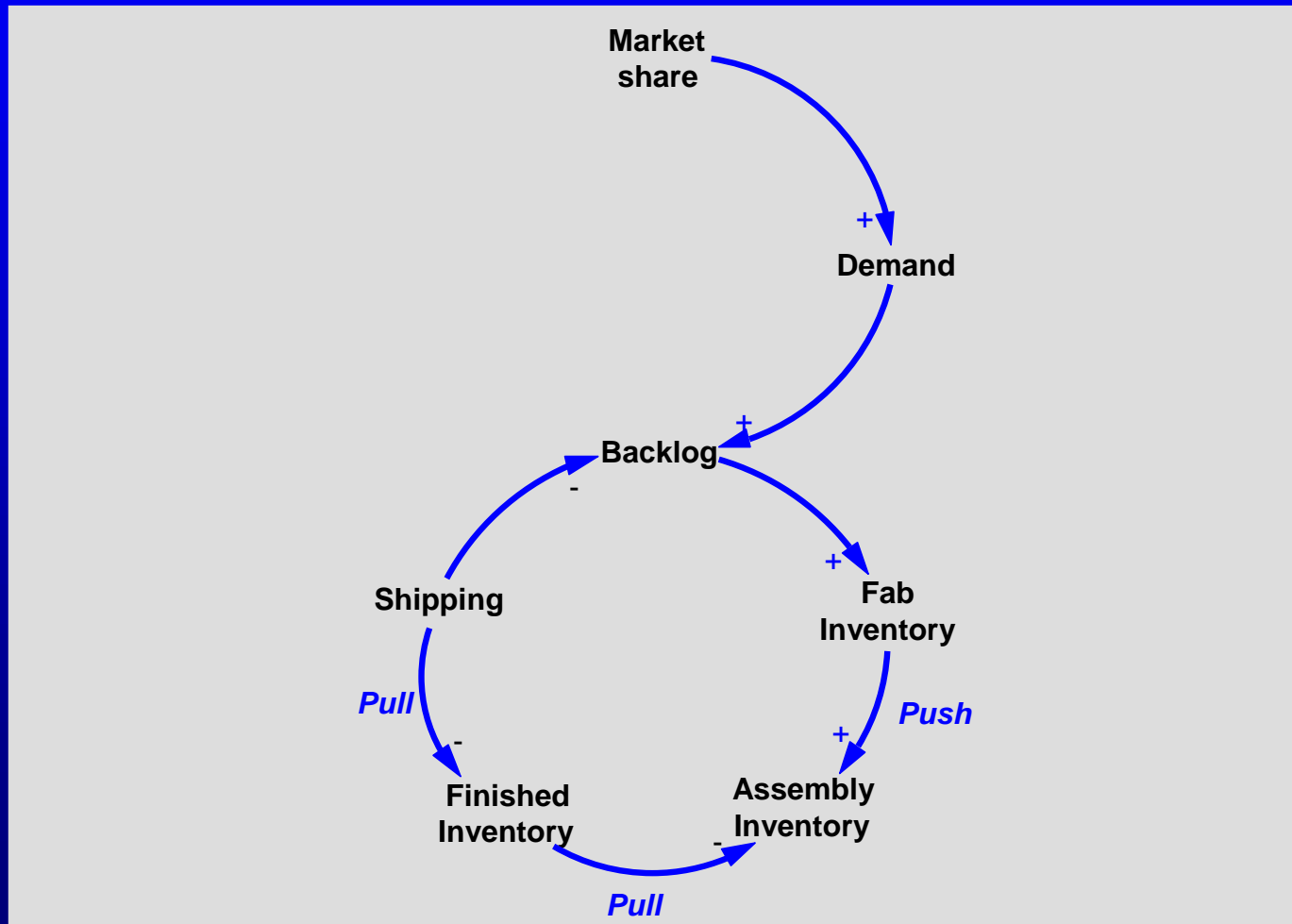
In this Model
Intel's Demand is Endogenous
(internally generated)

Eigenvalue Description

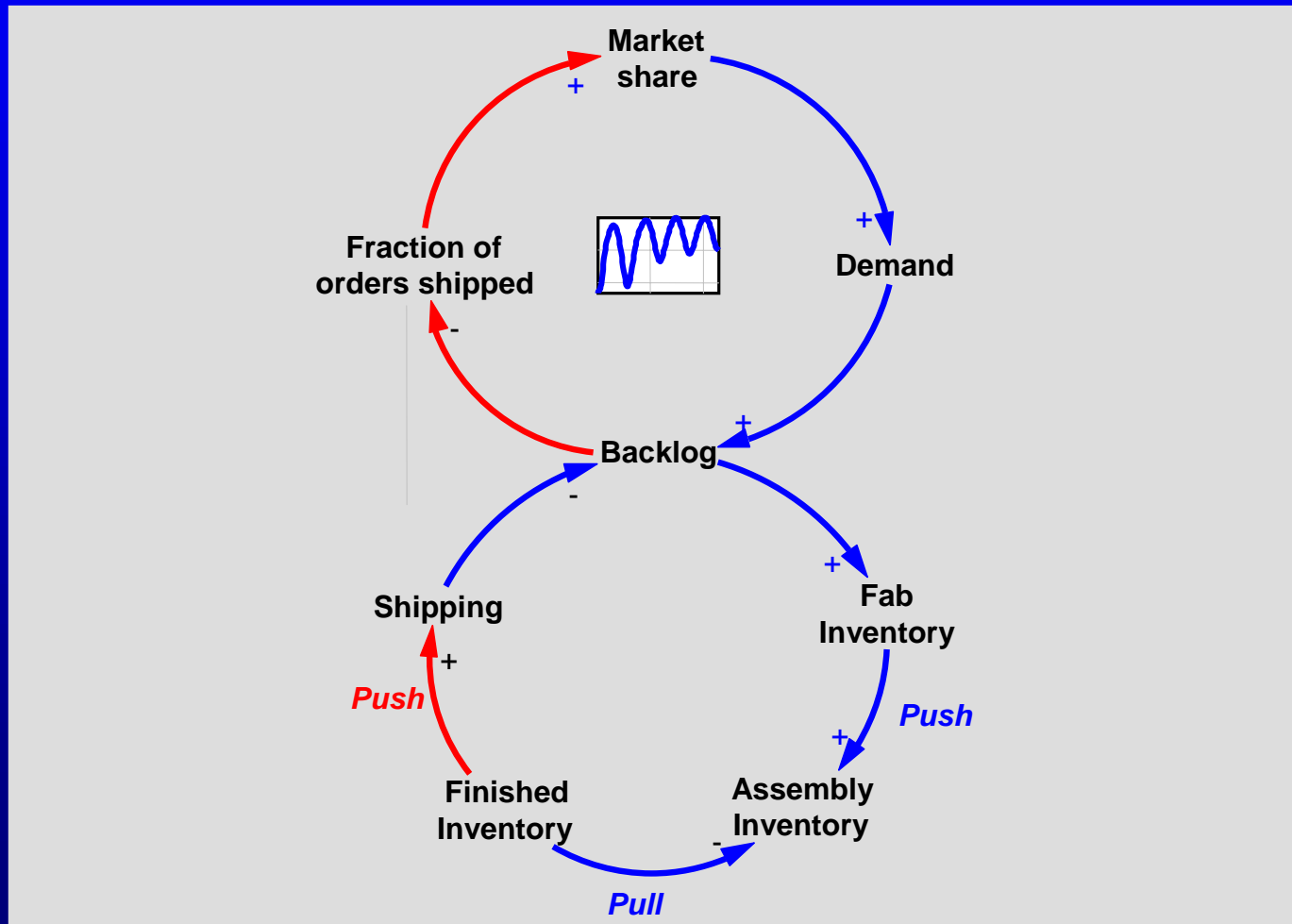
Second Eigen Pair



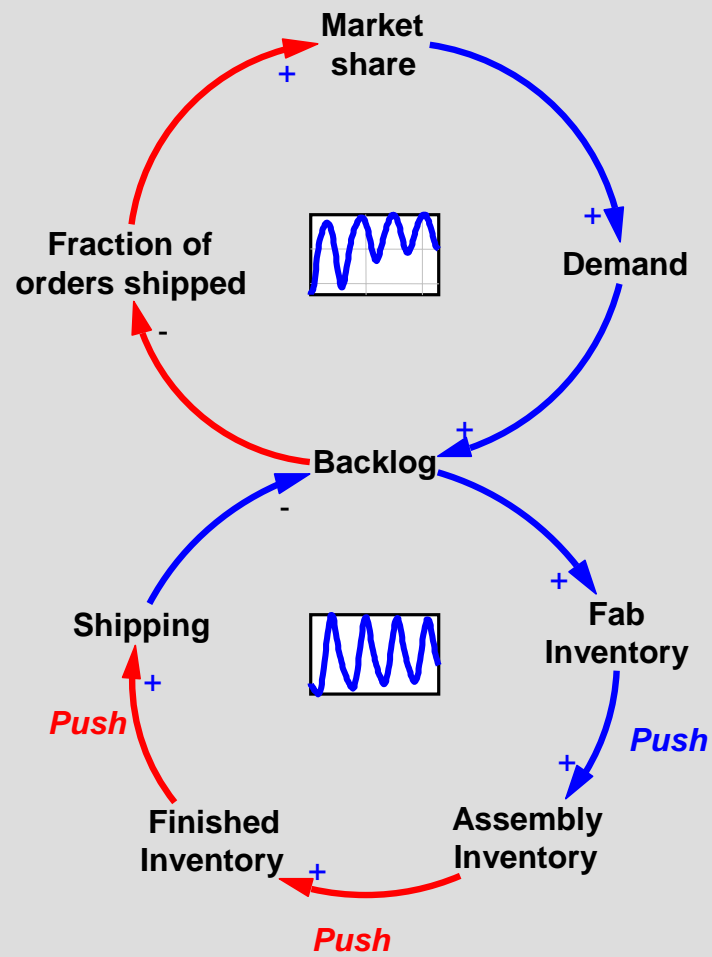
The Way Its Supposed to Work



Stockout: Pull \rightarrow Push



Pull Pull → Push Push



Stockouts Really Are a Problem

- Variable demand makes chain harder to manage, causing ...
- Stockouts, which ...
- Convert the system from pull to push ...
- Causing variations in demand

Solutions

- Hold more inventory?
- Internal markets?

Methodological Insights

- Eigenvalue analysis
 - Analysis is faster
 - Analysis is deeper
- TUI brings a new dimension to interacting with a model
- “Periodic table” of molecules
- Handbook and SD ...

Opportunities

- Further development of Intel SD models
- Exploration of combined Discrete event / SD / Agent-based modeling
- Simulating the dynamic impact of internal markets on supply chain
- Making eigenanalysis easier, integrating with TUI and Handbook

Summary

- Simulation engine: SD and DE
- System Dynamics: How we do it to ourselves
- Intel models: Counter-intuitive causes of undesirable behavior
- Computer-aided simulation analysis allows computer-aided thinking