An Object-Oriented Modular Simulation Framework for Semiconductor CVD Processing Systems

Jing Chen, Raymond A. Adomaitis

Objectives

- Design a set of computational tools for solving lumped and distributed parameter models generated in process design and simulation
- Develop flexible and reusable modular components for CVD systems
- Apply the technique of object-oriented design to reduce developing cycles of designing new systems and lower costs of CVD process design and simulations
- Facilitate distributed simulation through the application of Java and XML technique to heterogeneous data archiving, analysis and presentation

Why OOP and Modular?

- Features of OOP:
  - Encapsulation
  - Inheritance
  - Polymorphism

- Modular approach:
  - Allow different variable names among modules
  - Allow distributed simulation
  - May solve modules with different algorithms
  - Easy to change model structure

Framework

- Data
  - Archive data in XML format
  - Separates data applications and presentation
  - Facilitate distributed simulation and information sharing

- Modular Components
  - Standalone modules which could be physical parts or virtual parts describing transport or reaction mechanisms
  - Include information on properties of equipment or process and have subsystem equations associated with

- Systems
  - Specified by users through input of modularized components
  - Acting as a coordinator for information exchanging and distribution among modules in the system

Computational Tools

- Computational tools include two main packages:
  - Solvers offer different algorithms for solving AE/ODE/DAE systems
  - MWRtools used for discretizing PDE systems and solving the systems by weighted residual methods

Conclusions

- The application of OOP and modular approach greatly improves current modeling and simulation capability
- The development of the object-oriented simulation library offers a set of flexible and adaptable tools for solving large systems consisting of different application models
- Modularized components can be easily integrated to form a new CVD systems. The system can be solved in the sequential or simultaneous approach depending on the specific applications
- The application of Java and XML technology to wrap and manipulate data facilitates data distribution among dissimilar applications