

SYST 659 / IT 850 / SYST 850 Agent Based, Service Oriented, and Complex Adaptive Systems Architecting and Integration. (3:3:0). Fall 08. Prerequisites: SYST 520 and 619 or permission of instructor.

The notion of Complex Engineered Systems (CES) has emerged from initial efforts in the area of Complex Adaptive Systems and such emerging technologies as the Internet, GPS, wireless networking, and many others. These complex engineered systems are comprised of many heterogeneous subsystems and are characterized by observable complex behaviors that emerge as a result of interactions among the subsystems at several levels of organization and abstraction. Understanding, designing, building and controlling such complex systems is a major challenge for systems engineers today. Service-oriented architecture (SOA) is one of the major resulting realities. This provides a comprehensive plan to interrelate the enterprise with technology. SOA integrates talents and skills of an entire enterprise, with requisite and associated needs and computing know-how. We present a service-oriented modeling framework that employs agile, universal, and integrated business and technology language to facilitate design, architecture and integration initiatives.

This course is part of the degree track, concentration, and certificate in architecture based systems integration. There is much interest today in the engineering of systems that are comprised of other component systems, and where each of the component systems serve organizational and human purposes. These systems families are often categorized as system families, systems-of-systems, or federations of systems. The design of architectures is a major ingredient in the design of systems families and provides the conceptual basis for achieving system integration. Towards this end, the Department of Defense has issued new regulations for acquisition of systems. These require an architecture-based approach and focus on how a proposed system will be integrated with other existing or planned systems. Studies in this area cover: formulation of the system integration problem, definition of architecture frameworks, use of structured analysis and object oriented methodologies for the design of architectures, modeling and simulation for evaluation of architectures and approaches to integration, and interoperability. Both defense and industrial applications are considered.

References:

- Braha, D., Minai, A. A., and Bar-Yam, Y. (Eds), **Complex Engineering Systems**, Springer, Cambridge MA, 2006.
- Bell, M., **Service-Oriented Modeling: Service Analysis, Design, and Architecture**, Wiley, Hoboken, 2008.
- Marks, E. A., and Bell, M., **Service Oriented Architecture: A Planning and Implementation Guide for Business and Technology**, Wiley, Hoboken, 2006.
- Sage, A. P. and Rouse, W. B. (Eds.), **Handbook of Systems Engineering and Management**, John Wiley and Sons, New York, 1999.

The first three books would be well worth purchasing for the course. A second edition of the fourth book will be published towards the end of the year and it would be worthwhile awaiting this, especially for the coverage of material in this course. A plethora of contemporary literature available on the Internet concerning the subjects to be covered will be of much use, and experience will be gained in the Internet as a research tool during the course. A course web site on WebCT will be operational and put to much use.

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Course Call Numbers SYST 659 001 (71933), IT 850 001 (T77008) SYST 850 001 (77007) Fall 2008 Thursday from 4:30 PM to 7:10 PM in Room IN 205 (Innovation Hall).

Grades: 50% - examinations; 15% - term paper; 35% - home assignments. Two take home exams will be given. There will be a term paper assignment in the general area of the course, and periodic homework assignments.

SYST 659, IT 850, SYST 850 - Syllabus and Outline, (subject to change)

1. From Complex Adaptive Systems to Complex Engineered Systems (28 August, 4 September)
2. Engineering Complex Systems: Agent Orientation and Evolutionary Engineering (11 September)
3. Structure and Dynamics of Complex Product Design Issues (18, 25 September)
4. Understanding Complexity in Systems Engineering Design, Architecting, and Integration (2, 9, 16 October)
5. Models for Services (21, 30 October)
6. SOA Business Modeling (6, 13 November)
7. SOA Technology, and Services Identification, Analysis, and Design (20 November)
8. SOA Architecture Organization Model, Business Cases, and Return on Investment (4 December)
9. Mid Term exams due 21 October
10. Term Paper due 4 December
11. Final exams due 13 December 2008

APS. 26 June 2008