

Syracuse University

EECS/CASE Colloquium

Professor Krishna R. Pattipati
University of Connecticut

Wednesday, April 11, 2007
369 Link Hall
1:30 p.m.

Combinatorial Optimization Algorithms for Fault Diagnosis in Complex Systems

Abstract: System fault diagnosis is a key component of an integrated logistics process supporting system readiness. Fault Diagnosis involves identifying the *cause* of a malfunction by observing its *effects* at various monitoring points in a system. In this talk, we will first discuss a hybrid model-based technique that seamlessly employs quantitative (analytical) models and graph-based dependency models for intelligent diagnosis. Then, we focus on two key problems related to system fault diagnosis. The first problem involves on-equipment (also termed on-board), real-time diagnosis of most likely set of faults based on a sequence of, possibly uncertain, test outcomes. This is an intractable combinatorial optimization problem with a number of applications in engineering and medicine involving inference in factorial hidden Markov models and dynamic fusion of classifiers. We develop a polynomial algorithm with measurable performance based on Lagrangian relaxation and Viterbi decoding algorithms for dynamic multiple diagnosis. The second problem is one of constructing a diagnostic test sequence that achieves high fault isolation accuracy and yet consumes the lowest expected test cost and fault isolation time. This problem is related to the binary identification problem, another NP-hard optimization problem; it has applications in off-equipment (also called off-board), possibly remote, diagnosis of systems. Efficient troubleshooting and repair procedures, both on-board and off-board, help in minimizing the maintenance wait time, and in reducing and managing the spares in the supply chain management process. This paper provides brief review of algorithms for these two problems, along with a list of successful applications from aerospace, power, HVAC, and automotive industries.

About the Speaker

Krishna R. Pattipati is a Professor of Electrical and Computer Engineering at the University of Connecticut, Storrs, CT, USA. He has published over 330 articles, primarily in the application of systems theory and optimization techniques to large-scale systems. Prof. Pattipati received the Centennial Key to the Future award in 1984 from the IEEE Systems, Man and Cybernetics (SMC) Society, and was elected a Fellow of the IEEE in 1995 for his *contributions to discrete-optimization algorithms for large-scale systems and team decision-making*. He received the Andrew P. Sage award for the Best SMC Transactions Paper for 1999, Barry Carlton award for the Best AES Transactions Paper for 2000, the 2002 NASA Space Act Award, the 2003 AAUP Research Excellence Award and the 2005 School of Engineering Teaching Excellence Award at the University of Connecticut. He also won the best technical paper awards at the 1985, 1990, 1994, 2002, 2004 and 2005 IEEE AUTOTEST Conferences, and at the 1997 and 2004 Command and Control Conferences. Prof. Pattipati served as Editor-in-Chief of the IEEE Transactions on SMC-Cybernetics (Part B) during 1998-2001.

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