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Overview of Engineering systems modeling and applications

Formulation of decision making problems for Engineering Systems. Modeling techniques and example/applications for Engineering problems

Week 1 – Introduction & Systemic view

15 March: 14,00-16,00 in classroom CD

16 March: 14,00-16,00 in classroom U

Overview of systemic approach, general framework for formulating engineering decision problems and improving their performance. The role of Operations Research: identification of objective function, variables, constraints and parameters.

Week 2 – LP & Sensitivity Analysis

5 April: 14,00-16,00 in classroom CD

6 April: 14,00-16,00 in classroom U

Introduction to Linear Programming as the simplest modeling approach. Overview of solutions methods and simple examples in Excel. Definition and importance of Sensitivity Analysis for evaluating uncertain scenarios and the stability of proposed solutions.

Week 3 – Network problems and Multi-Objective Systems

12 April: 14,00-16,00 in classroom CD

13 April: 14,00-16,00 in classroom U

Introduction to the use of Networks as a modeling tool to efficiently solve several large problems. The “Minimum Cost” problem. Multi-objective Engineering Systems: Dominance and Trade-off curve (Pareto Front).

Week 4 – Integer Programming and Heuristics

19 April: 14,00-16,00 in classroom CD

20 April: 14,00-16,00 in classroom M

How to handle Yes/No decisions and integer variables. How to formulate logic constraints. Typical Integer Programming Problems (Knapsack and Traveling Salesman) and their applications in the real world. The challenge of their solutions. Introduction to Heuristics.

Week 5 – Engineering Economics

26 April: 14,00-16,00 in classroom CD

27 April: 14,00-16,00 in classroom U

Economic evaluation of Engineering Systems. Interest rate, “time is money”, Net Present Value and Internal Rate of Return. The role of Depreciation and Taxes. The use of Operations Research for optimizing financial decisions.

Bio

Dr. Luca Quadrifoglio graduated with the Laurea in Chemical Engineering (1996) from the Politecnico of Milan (Italy) and worked for Snamprogetti (ENI Group) in Milan for five years, developing decision support tools for the firm's executives. He then received his M.S. in Engineering Management (2002) and Ph.D. (2005) degrees from the Daniel J. Epstein Department of Industrial and Systems Engineering at the University of Southern California. Then he worked as a Postdoctoral Research Associate at the USC's Department of Homeland Security Center for Risk and Economic Analysis of Terrorism Events (CREATE) until August 2006, when he joined the Faculty of the Zachry Department of Civil Engineering (Transportation Division) at Texas A&M University. Dr. Quadrifoglio has more than 50 refereed publications, won the 2004 Council of University Transportation Center (CUTC) National Student Award for best publication in Science and Technology, the 2006 Pritsker Doctoral Dissertation Award (3rd place) and a Fulbright Award in 2016. He was the Editor for Paratransit Committee (AP060) at TRB and he is on the Editorial Board for Transportation Research – Part B.