

SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND  
DEVELOPMENT (D3)

Space Technology and System Management Practices and Tools (4)

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KINEMATIC MODEL FOR RESOURCE CONSTRAINED PROJECTS SCHEDULING PROBLEM  
WITH UNDER UNCERTAINTIES – A SPACE SEGMENT SUBSYSTEM CASE STUDY.**Abstract**

The Research on project scheduling problem was intensified from the recognition that network models CPM (Critical Path Method), PERT (Project Evaluation Review Technique) and PDM (Precedence Diagram Method) are based on the assumption that all needed resources will be available. The importance of project scheduling and control is bolstered with many examples where the inadequate scheduling and control are often identified as the most common causes of project failure. Throughout systems life cycle the techniques and approaches project management are mainly involved in the planning, programming and control of project activities conducted in context of resource constrained under uncertainties. In addition of scenarios the complexity of the projects, there are some classes of products, typical of the aerospace systems, which are problematic for current methods of resource constrained project scheduling under uncertainty. The existing methods fail because they suffer from one or more of the following limitations: focused mainly on the basic RCPSP (Resource Constrained Project Scheduling Problem) model; dealing with only one source of uncertainty, mostly in duration of activities; and do not model uncertainties.

This paper presents the kinematic model of projects scheduling which considering the inherent restrictions in nature of the projects: precedence of project activities; uncertainties of the duration of project activities; and uncertainties in availability of resources for execution of project activities. The project scheduling may be considered as an open kinematic chain, which is formed by: a set of rigid links (precedence of activities) that are connected by joints (activities of project) with one fixed extremity (activity that represents the beginning of the project) and one free extremity (activity that represents the end of the project). The kinematic model of projects scheduling provides a graph and mathematical model with the advantages: estimation of the project duration and resources due to uncertainties; estimation of the uncertainties due to project duration and resources; improvement of the outcomes of planning and scheduling of project activities; and assists the dynamics of projects providing information for collaboration policy of the durations and resources between project activities and between different projects. This article describes the Resource Constrained Project Scheduling Problem under uncertainties, discuss previous work on planning under uncertainty, and presentation of the kinematic model of projects scheduling with resource constrained under uncertainties along with a small example of implementation in a space segment subsystem.