



Formal development and evaluation of narrow passageway system operations

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Abstract

This study applies a new intelligent transportation methodology for transforming informal operations concepts for narrow passageway systems into system-level designs, which will formal enough to support automated validation of anticipated component- and system-level behaviours. Models and specifications of behaviour are formally designed as labelled transition systems. Each object is the management system is assumed to have behaviour that can be defined by a finite state machine; thus, the waterway management system architecture is modelled as a network of communicating finite state machines. Architecture-level behaviours are validated using the Labelled Transition System Analyzer (LTSA). We exercise the methodology by working step by step through the synthesis and validation of a high-level behaviour model for a vessel passing through a waterway network (i.e., canal).

Keywords: Synthesis; Validation; Verification; Narrow Waterways Management; System Behaviour Model.

Introduction

Narrow passageway systems (e.g., waterway, work zone, tunnel, one-lane bridge and railroad applications) are large multidisciplinary complex systems characterized by geographically distributed system structures, concurrent subsystem-level behaviours, and end-to-end system life-cycles that may last decades. From a performance perspective, sophisticated techniques for engineering analysis are justified by adverse economics of poor system throughput. Within the waterways domain, for example, recent research has focused on assessment of overall system performance, congestion and delays in single and adjacent locks - see, for example, references (DeSalvo and

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