

## Large scale Robust Optimization of Bulk Port Operations

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### Abstract

The primary objective of this research is to develop large scale robust optimization algorithms providing sustainable solutions for bulk port operations accounting for uncertainties and disruptions in operations. While significant contributions have been made for container terminals, relatively little attention has been directed to the use of operations research methods and techniques to optimize bulk port operations. In this research we aim to develop large scale mathematical models for bulk port operations, with emphasis on integrated planning; furthermore, we plan to include robustness to account for uncertainties in operations. A broader objective of our work is to study how the methodologies developed for bulk ports can be extended to multi-modal transport operations, including other domains such as container ports, airlines and railways, with a view to optimize the usage and operations of existing infrastructure to achieve sustainability in the mobility of goods and people. The devised models and algorithms will be tested and validated in a real-world context using as a case study, the SAQR port in Ras Al Khaimah, UAE.



**Fig. 1 Ship loading into big vessels**



**Fig.2 Conveyor system for bulk material transfer**