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The study of the unidirectional quay crane scheduling problem:  
complexity and risk-aversion

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**Highlights**

- The computational complexity of the unidirectional quay crane scheduling problem is studied;
- A tighter mathematical formulation for the studied problem is proposed;
- A makespan constrained balance model is proposed to diminish the risk of vessel instability;
- A makespan constrained robust model is proposed to cater for the risk of data uncertainty;
- Comprehensive numerical experiments are carried out to test the performance of the proposed models.

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