Research School for Operations
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Optimal Decision Making under Uncertainty in Biomanufacturing

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Biomanufacturing processes are subjected to high process variability due to the use of living cells in manufacturing operations. This variability causes failure risks, uncertainty in production yield and high operating costs to the biomanufacturing companies. To address this, the main research objective is to develop new stochastic models to economically optimize biomanufacturing decisions under high process variability, failure risks, and high operating costs. By combining the knowledge from the biological and chemical engineering, stochastic control, reliability theory and manufacturing systems engineering, an inter-disciplinary modelling and optimization framework will be built. The framework will provide effective tools to link the cell level dynamics of biomanufacturing processes with manufacturing system level dynamics. In collaboration with business partners from biomanufacturing industry, Markov decision models will be used to determine the optimal operating policies to reduce biomanufacturing costs and lead times. Structural characteristics of optimal policies will be derived and optimal operating policies will be analyzed theoretically and numerically. The analysis will be used to propose easily implemented policies to the business partners and the performance of the optimal decision policies will be compared to the current policies used in practice.