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FAT-based adaptive and velocity feedback control of cooperative manipulators handling a flexible object
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Abstract
The previous regressor-based control method to control two cooperative manipulators in handling a deformable object leads to complex calculations and complicated programming in experimental hardware tests. There is an existing lack of studies about the development of the controller based on a partial differential equation (PDE)-based model and considering the model's uncertainties. Previous studies have shown fewer experimental validations regarding two cooperative manipulators that handle deformable objects under uncertain model parameters. This study proposes a composite controller comprising a function approximation technique (FAT)-based adaptive control (FATAC) for a slow subsystem and a velocity feedback control (VFC) for a fast subsystem. The proposed FATAC is used for trajectory tracking, and VFC is used to suppress the vibration of the deformable object. Lyapunov stability analysis has been carried out to design controllers that stabilize a non-linear system of two cooperative manipulators handling the flexible object. Simulation and hardware experimental tests have been carried out to validate the performance of proposed controllers. The results verified that the proposed composite controller comprising the FATAC has successfully driven the cooperative manipulators to handle the deformable object so that it follows the desired trajectories. The VFC has successfully suppressed the transverse vibration of the deformable object.

Author Keywords
Composite control; flexible beam; function approximation technique; slow-fast subsystems

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