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Task-space coordination control of bilateral human-swarm systems.

Summary: This paper proposes a system framework and control algorithms that enable a human operator
to simultaneously interact with a group of swarm robots in a remote environment. In order to cope with
kinematic dissimilarity and spatial discrepancy between human and swarm systems, a task-oriented control
framework is developed. Based on the proposed control system, the human operator is able to convey
action commands to the swarm, and the swarm robot can provide feedback information for the human
operator. Additionally, the cognitive limitation of the human operator due to lack of entire information
about the remote environment can be mitigated by utilizing the null-space of the swarm robot. Stability and
performance of the proposed control system are investigated when the communication channels are subject to
time delays and the system is influenced by non-passive external forces. The control algorithms are validated
via numerical simulations on a 3-DOF robotic manipulator with a group of mobile swarm robot.

Keywords: task-space coordination control; bilateral human-swarm systems; feedback information
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