Summary: A new approach to trajectory planning for underactuated mechanical systems is presented and discussed based on analysis of feasible behaviors of a standard 2-DOF benchmark example – the cart-pendulum system. Following the Controlled Lagrangians approach of A. Bloch et al. [IEEE Trans. Autom. Control 45, No. 12, 2253–2270 (2000; Zbl 1056.93604)], we present and reestablish known conditions and forms of feedback control laws for this example, which are leading to an equivalent completely integrable closed-loop Euler-Lagrange system; and then extend them. As shown, full integrability and, in particular, the presence of a linear in velocities first integral of dynamics plays the key role in an elegant new procedure for trajectory planning.

MSC:
93B52 Feedback control
70Q05 Control of mechanical systems
70S05 Lagrangian formalism and Hamiltonian formalism in mechanics of particles and systems

Keywords:
underactuated mechanical systems; cart-pendulum system; controlled Lagrangians; virtual holonomic constraints; motion and trajectory planning; feedback equivalence

Full Text: DOI

References:
[16] Kolesnichenko, O.; Shiriaev, A., Partial stabilization of under-actuated Euler-Lagrange systems via a class of feedback trans-


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