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Riccati equations with final state penalization and associated with dynamical systems subjected to unbounded control actions are considered. The class of dynamics discussed is assumed to satisfy Singular Estimate Control (SEC) condition. The distinct feature of the problem under study is controlled singularity of the gain operator (resp. optimal transfer function) exhibited at the terminal time (resp. terminal and initial time). This is caused by the unboundedness of control operator coupled with the fact that "non-smooth" Bolza problem is considered. The theory is applied to three different systems of coupled PDEs as examples: a thermoelastic plate system with thermal boundary control, a structure acoustic model with point boundary control, and a fluid structure interaction model. (Received August 22, 2005)