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Improved vertical control by optimal actuator selection on TCV FEDERICO PESAMOSCA, FEDERICO FELICI, STEFANO CODA, CRISTIAN GALPERTI, Swiss Federal Institute of Technology, TCV TEAM — High performance elongated plasmas are prone to the vertical instability which requires feedback control for stable operation, a task routinely performed in tokamaks but not optimized for the TCV case, where only a subset of the available poloidal field coils is used for this purpose. In this work a new general algorithm for synthesizing an optimized vertical controller is presented and its application on TCV is discussed. The design is based on a linearized model for the tokamak plasma-vessel-coils electromagnetic dynamics, which is used to determine the optimal linear combination of control currents mostly coupled with the unstable vertical mode of the system. In this way, it is possible to assign all relevant coils to vertical stabilization, while the remaining directions can be used for position and shape control. This approach, combined with structured H-infinity synthesis, determines the best trade-off between stability margin and input request for stabilization, effectively removing the need for shot-by-shot tuning. Dedicated TCV experiments confirm the efficacy of the new controller with a lower voltage requirement for stabilizing the same plasma, thus reducing the risk of power supply saturation and the consequent loss of vertical control.

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