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# Computable reliable bounds for Poincaré–Friedrichs constants via Čech–de-Rham complexes

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We derive computable and reliable upper bounds for Poincaré–Friedrichs constants of classical Sobolev spaces and, more generally, Sobolev de-Rham complexes. The upper bounds are in terms of local Poincaré–Friedrichs constants over subdomains and the smallest singular value of a finite-dimensional operator that is easily assembled from the geometric setting. Thus we reduce the computational effort when computing the Poincaré–Friedrichs constant of finite de-Rham complexes, and we provide computable reliable bounds even for the original Sobolev de-Rham complex. The reduction to a finite-dimensional system uses diagram chasing within a Čech–de-Rham complex. Additionally, we utilize estimates for Poincaré–Friedrichs constants over local finite element patches. Part of this is joint work with Théophile Chaumont-Frelet and Martin Vohralík.

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