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On damped second-order gradient systems

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Using small deformations of the total energy, as introduced in [31], we establish that damped second order gradient systems u′′(t)+γu′(t)+∇G(u(t))=0, Turn MathJax of may be viewed as quasi-gradient systems. In order to study the asymptotic behavior of these systems, we prove that any (nontrivial) desingularizing function appearing in KL inequality satisfies φ(s)⊠cs√ whenever the original function is definable and CC. Variants to this result are given. These facts are used in turn to prove that a desingularizing function of the potential G also desingularizes the total energy and its deformed versions. Our approach brings forward several results interesting for their own sake: we provide an asymptotic alternative for quasi-gradient systems, either a trajectory converges, or its norm tends to infinity. The convergence rates are also analyzed by an original method based on a one-dimensional worst-case gradient system. We conclude by establishing the convergence of solutions of damped second order systems in various cases including the definable case. The real-analytic case is recovered and some results concerning convex functions are also derived.

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