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The entropy method - from analysis to numerics

Parabolic equations occur in several aspects of physics, chemistry, and biology describing the evolution of densities, concentrations, bacteria and much more. In several cases these equation possess a Lyapunov functional being motivated from physics which is called the entropy. The entropy method relies on employing this non-linear structure of the equations.
On the one hand this method is a tool to discuss the long time behavior of the equations. On the other hand it is possible to show that the solution is non-negative without requiring the maximum principle. This properties are especially useful if we want to derive structure preserving numerical schemes, where the maximum principle is not available. This lecture explains how to apply the entropy method to non-linear parabolic equations for some introductory examples. In a second part the students learn how to transfer these ideas of the entropy method into a numerical scheme conserving the structure of the equation.