

stability regions

For the ODE $y'(t) = \lambda y(t)$ Runge-Kutta methods have the form

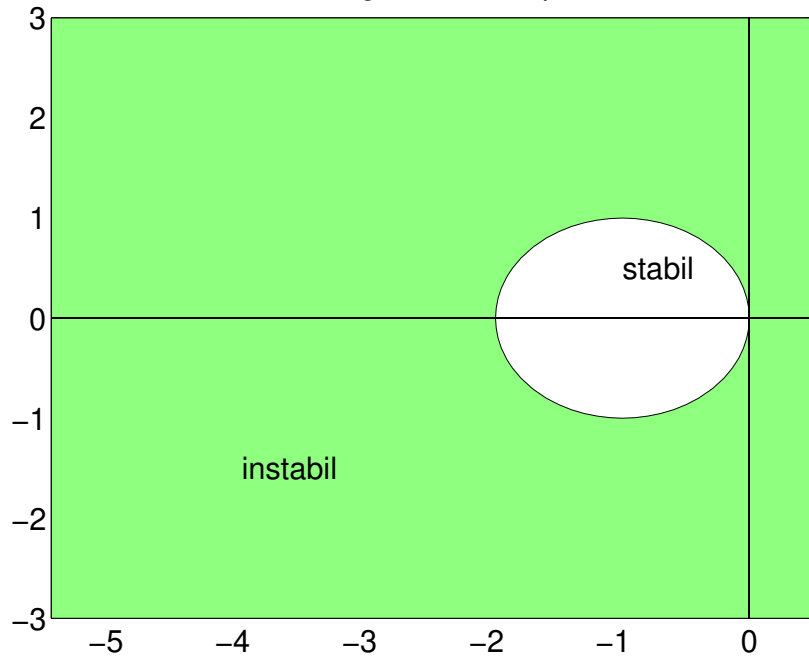
$$y_{i+1} = R(z)y_i \quad \text{with } z := \lambda h.$$

Examples:

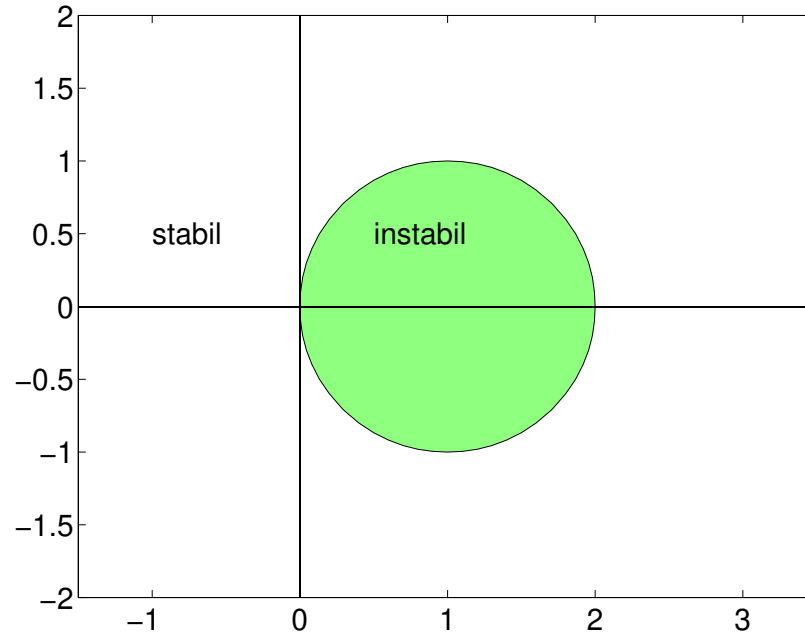
$$\begin{aligned} R_{eE}(z) &= 1 + z, & R_{iE}(z) &= \frac{1}{1 - z}, \\ R_{CN}(z) &= \frac{1 + z/2}{1 - z/2}, & R_{RK4}(z) &= 1 + z + \frac{1}{2}z^2 + \frac{1}{6}z^3 + \frac{1}{24}z^4. \end{aligned}$$

<u>stability region:</u> $S = \{z \in \mathbb{C} \mid R(z) \leq 1\}$
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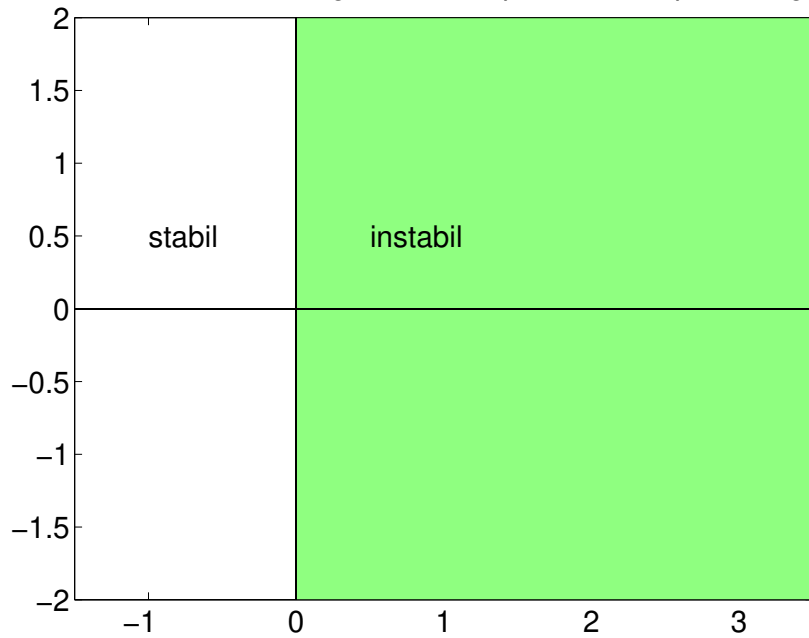
Stabilitaetsgebiet von expl. Euler



Stabilitaetsgebiet von impl. Euler



Stabilitaetsgebiet der impliziten Mittelpunktsregel



Stabilitaetsgebiet von RK4

