

For each method below, find its Butcher tableau, check zero-stability, find R^{ABS} , and consistency order. The methods will need some de-constructing and re-constructing!

Problem 1: L -stable alternative to trapezoidal; TR-BDF2.

$$U^* = U^n + \frac{h}{4}(f(U^n) + f(U^*)), \quad U^{n+1} = \frac{1}{3}(4U^* - U^n + hf(U^{n+1})).$$

Problem 2: (popular in TVD WENO).

$$U^{(1)} = U^n + hf(U^n), \quad U^{(2)} = \frac{3}{4}U^n + \frac{1}{4}U^{(1)} + \frac{1}{4}hf(U^{(1)}), \quad U^{n+1} = \frac{1}{3}U^n + \frac{2}{3}U^{(2)} + \frac{2}{3}hf(U^{(2)}).$$