In ex. (16) $S = \frac{1000}{1/2} = 2000$

Stiffness is also very common in nonlinear systems of ODEs

$$\dot{\vec{y}}(t) = \vec{f}(t, \vec{y}(t))$$

A <u>local</u> measure of stiffness is obtained by linearizing the system of ODEs at some point (of interest!) $t_1, \vec{y}_1$:

$$\vec{f}(t, \vec{y}) \approx \vec{f}(t_1, \vec{y}_1) + \frac{\partial \vec{f}}{\partial t}(t_1, \vec{y}_1) \cdot (t - t_1) + \underbrace{\frac{\partial \vec{f}}{\partial \vec{y}}}_{\text{Jacobian matrix } J = \frac{\partial \vec{f}}{\partial \vec{y}}} (t_1, \vec{y}_1) \cdot (\vec{y} - \vec{y}_1)$$

So one obtains the following inhomogeneous linear system of ODEs

$$\dot{\vec{y}}(t) = \underbrace{J(t_1, \vec{y}_1)}_{A} \vec{y}(t) + \underbrace{\left(\vec{f}(t_1, \vec{y}_1) + \frac{\partial \vec{f}}{\partial t}(t_1, \vec{y}_1) \cdot (t - t_1) - J(t_1, \vec{y}_1) \vec{y}_1 \right)}_{\vec{b}(t)}$$