1.The Semenov Model

http://demonstrations.wolfram.com/TheSemenovModel/

Semenov developed a model that describes the thermal ignition phenomenon quantitatively

Denote the

$x_1 \equiv \gamma \qquad x_2 \equiv T \qquad \varepsilon := 0.15$

where T is a dimensionless temperature, γ depends on the overall heat transfer coefficient, and ε depends on the activation energy

The dimensionles equation

$$f_1 := e^{-\frac{1}{\varepsilon \cdot x_2}} - x_1 \cdot (x_2 - 1) \equiv 0$$

Координаты начальных точек

$X0_1 := 0.1$

$$X0_2 := \text{solve}\left(e^{-\frac{1}{\varepsilon \cdot T}} - X0_1 \cdot (T-1) \equiv 0, T, 0, 15\right)$$

⊞—Dragilev's Method

$\text{tmin} := 0 \qquad \text{tmax} := -48 \qquad \Delta t := -0.06 \qquad N := \frac{\text{tmax}}{\Delta t} \qquad N = 800$

$B := D(X0, \text{tmin}, \text{tmax}, N) \qquad \gamma(t) := 0.021 + 0.0025 \cdot t$

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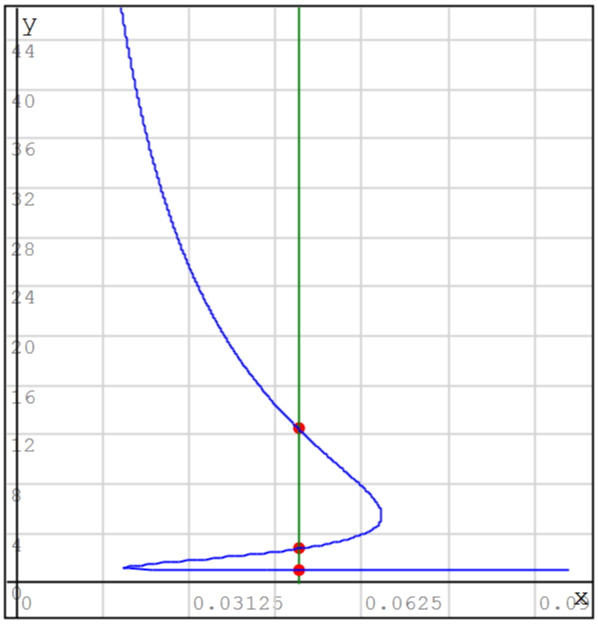
T(t):= | root := solve( e^(-1/(ε·y)) - γ(t)·(y-1) ≡ 0 , y , 0 , 50 )
       | T := if t > 18.8
       |        stack(root , 100 , 100)
       |      else
       |        root
```

$\tau := 0 .. 28$

Dependence T of on the parameter γ
The red dots show the stationary states



2.Continuously Stirred Tank Reactor

http://demonstrations.wolfram.com/ContinuouslyStirredTankReactorUsingArcLengthParameter/

x1-dimensionless concentration, x2-dimensionless temperature, Da-Damköhler number, γ-dimensionless activation energy, β-dimensionless heat transfer coefficient

$B := 10$ $\quad Da := 0.03084$ $\quad \gamma := 20$ $\quad T0 := -5$

Denote the

$x_1 \equiv x$ $\quad x_2 \equiv T$ $\quad x_3 \equiv Da$

Координаты начальных точек

$X0_1 := 0.004$ $\quad X0_2 := -1.85$ $\quad X0_3 := 0.03084$

$tmin := 0$ $\quad tmax := -9.8$ $\quad \Delta t := -0.2$ $\quad N := \frac{tmax}{\Delta t}$

The dimensionless equations

$$\varphi := -x_2 + B\cdot x_3\cdot\left(1 - x_1\right)\cdot e^{\frac{x_2}{1+\frac{x_2}{\gamma}}}$$

$$f_1 := -x_1 + x_3\cdot\left(1 - x_1\right)\cdot e^{\frac{x_2}{1+\frac{x_2}{\gamma}}} \equiv 0$$

$tstart := 6$ $\quad tend := 30$

for $i \in tstart .. tend$

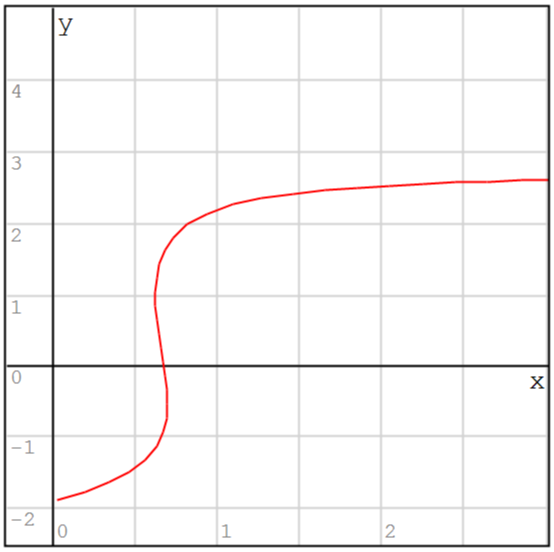
$\quad \beta_i := 0.2 + 0.04\cdot i$

$\quad f_2 := \varphi - \beta_i\cdot x_2$

$\quad K_i := D(X0, tmin, tmax, N)$

$\tau := tstart .. 2\cdot tend - tstart$

Dependence T of on the parameter Da.
By increasing the heat transfer
coefficient the temperature drops



$X0_1 := 1.496446999$ $X0_2 := -0.9574371296$ $X0_3 := 0$