

## Abstrak

Suatu sistem persamaan diferensial yang berbentuk:

$$\begin{cases} \frac{dx}{dt} = F(x, y) \\ \frac{dy}{dt} = G(x, y) \end{cases}$$

di mana fungsi-fungsi  $F$  dan  $G$  keduanya tidak tergantung terhadap  $t$  disebut sistem otonomus. Titik  $(x_0, y_0)$  yang memenuhi  $F(x_0, y_0) = G(x_0, y_0) = 0$  disebut titik kritis dari sistem.

Sistem otonomus berbentuk:

$$\begin{cases} \frac{dx}{dt} = ax + by + F(x, y) \\ \frac{dy}{dt} = cx + dy + G(x, y) \end{cases}$$

dengan  $ad - bc \neq 0$ , titik kritis  $(0,0)$ , dan fungsi  $F$  dan  $G$  mempunyai turunan parsial tingkat pertama yang kontinu dan memenuhi syarat:

$$\lim_{(x,y) \rightarrow (0,0)} \frac{F(x, y)}{\sqrt{x^2 + y^2}} = \lim_{(x,y) \rightarrow (0,0)} \frac{G(x, y)}{\sqrt{x^2 + y^2}} = 0$$

disebut sistem hampir linear di sekitar titik kritis  $(0,0)$  dan dapat dihampiri oleh sistem linear

$$\begin{cases} \frac{dx}{dt} = ax + by \\ \frac{dy}{dt} = cx + dy \end{cases}$$

Titik kritis  $(0,0)$  dari sistem hampir linear stabil asimtotis jika  $(0,0)$  adalah titik kritis stabil asimtotis dari sistem yang dilinearakan. Titik kritis  $(0,0)$  dari sistem hampir linear takstabil jika  $(0,0)$  adalah titik kritis takstabil dari sistem yang dilinearakan.

## Abstract

The differential equation system of the form:

$$\begin{cases} \frac{dx}{dt} = F(x, y) \\ \frac{dy}{dt} = G(x, y) \end{cases}$$

where functions  $F$  and  $G$  do not depend on the time is called autonomous. A point  $(x_g, y_g)$  such that  $F(x_g, y_g) = G(x_g, y_g) = 0$  is called a critical point of the system.

An autonomous system of the form:

$$\begin{cases} \frac{dx}{dt} = ax + by + F(x, y) \\ \frac{dy}{dt} = cx + dy + G(x, y) \end{cases}$$

with  $ad - bc \neq 0$ , critical point  $(0,0)$  and  $F$  and  $G$  have continuous first partial derivatives and satisfy the limit condition

$$\lim_{(x,y) \rightarrow (0,0)} \frac{F(x, y)}{\sqrt{x^2 + y^2}} = \lim_{(x,y) \rightarrow (0,0)} \frac{G(x, y)}{\sqrt{x^2 + y^2}} = 0$$

is called an almost linear system in the neighborhood of the critical point  $(0,0)$  and can be approached by the linear system

$$\begin{cases} \frac{dx}{dt} = ax + by \\ \frac{dy}{dt} = cx + dy \end{cases}$$

The critical point  $(0,0)$  of the almost linear system is asymptotically stable if it is an asymptotically stable critical point of the linearized system.

The critical point  $(0,0)$  of the almost linear system is unstable if it is an unstable critical point of the linearized system.