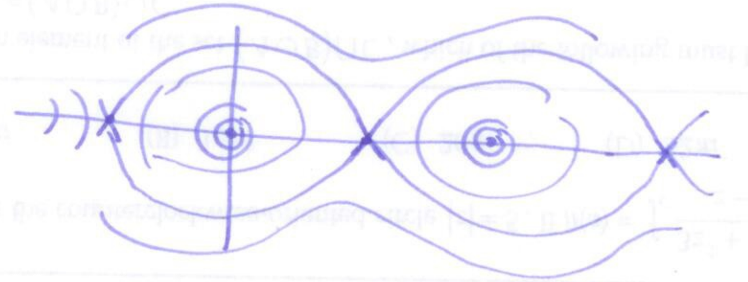
$$DF(x_0) = \begin{bmatrix} 0 & 1 \\ -w^2 & 0 \end{bmatrix} \quad n \text{ even} \qquad \begin{bmatrix} 0 & 1 \\ w^2 & 0 \end{bmatrix} \quad n \text{ odd}$$

eigenvalues $\lambda^2 + w^2 = 0$ $\qquad$ $\lambda^2 - w^2 = 0$

$\lambda = \pm wi$ $\qquad$ $\lambda = \pm w$

stable periodic $\qquad$ saddle.

get:



§3.1 Laplace transform

L : functions $\longrightarrow$ functions

$$f \longmapsto \int_0^\infty e^{-st} f(t)\,dt.$$

$f(t)$ $\qquad$ $L(f)(s) \leftarrow$ notation write this as F

Examples

$f(t) = 1$

$$F(s) = \int_0^\infty e^{-st}\,dt = \left[-\frac{1}{s}e^{-st}\right]_0^\infty = \lim_{t\to\infty} -\frac{1}{s}e^{-st} + \frac{1}{s} = \frac{1}{s} \quad (s>0).$$

$f(t) = t$

$$F(s) = \int_0^\infty e^{-st}\cdot t\,dt = \left[-\frac{1}{s}e^{-st}t\right]_0^\infty - \int_0^\infty -\frac{1}{s}e^{-st}\,dt.$$

$$= \lim_{t\to\infty} -\frac{1}{s^2}e^{-st} + \frac{1}{s^2} = \frac{1}{s^2} \quad (s>0).$$

FACT $f(t) = t^n$ $\qquad$ $F(s) = \dfrac{n!}{s^{n+1}}$