## Lyapunov's Direct Method

Consider the autonomous continuous-time system

$$\dot{x}(t) = f(x(t))$$

with Equilibrium Point at $x = 0$. The stability analysis of the equilibrium point in such a system is a difficult task in general. This is due to the fact that we cannot write a simple formula relating the trajectory to the initial state.

The idea behind Lyapunov's "direct" method is to establish properties of the equilibrium point (or, more generally, of the nonlinear system) by studying how certain carefully selected scalar functions of the state evolve as the system state evolves.