

Systems of Ordinary Differential Equations > Nonlinear Systems of Three and More Equations

1.
$$ax'_t = (b-c)yz$$
, $by'_t = (c-a)zx$, $cz'_t = (a-b)xy$.

First integrals:

$$ax^{2} + by^{2} + cz^{2} = C_{1},$$

$$a^{2}x^{2} + b^{2}y^{2} + c^{2}z^{2} = C_{2},$$

where C_1 and C_2 are arbitrary constants. On solving the integrals for y and z and on substituting the resulting expressions into the first equation of the system, one arrives at a separable first-order equation.

Reference

Kamke, E., Differentialgleichungen: Lösungsmethoden und Lösungen, I, Gewöhnliche Differentialgleichungen, B. G. Teubner, Leipzig, 1977.

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http://eqworld.ipmnet.ru/en/solutions/sysode/sode0401.pdf