

SURVEY OF TOPICS NOT COVERED IN MATH 386

Chapter 6 — Nonlinear systems [See Math 489]

e.g. find solution $x = x(t), y = y(t)$ of

$$\begin{cases} \frac{dx}{dt} = (1 - 2y)x \\ \frac{dy}{dt} = (-3 + x)y \end{cases}$$

Real-world systems are mostly nonlinear, and many are chaotic.

Chapter 7 — Laplace transform

e.g. $x'' + p(t)x' + q(t)x = f(t)$ where $f(t)$ has jumps and is not periodic. Not suitable for Method of Undetermined Coefficients or for Fourier Series. Suitable for “Transform” methods. (*Note.* If $f(t)$ is periodic then one can use Fourier series, like in Sec. 9.4.)

e.g. Electrical circuits where external voltage is suddenly applied at $t = 0$.

Chapter 8 — Power Series [See Math 441]

e.g. $y'' - y = 0$ is solved by $y = 1 + x + x^2/2! + x^3/3! + \cdots$ (which equals e^x) and by $y = 1 - x + x^2/2! - x^3/3! + \cdots$ (which equals e^{-x}).

Applications: power series can be used to find solutions for vibrating circular drums, and for wave functions in quantum mechanics, etc.