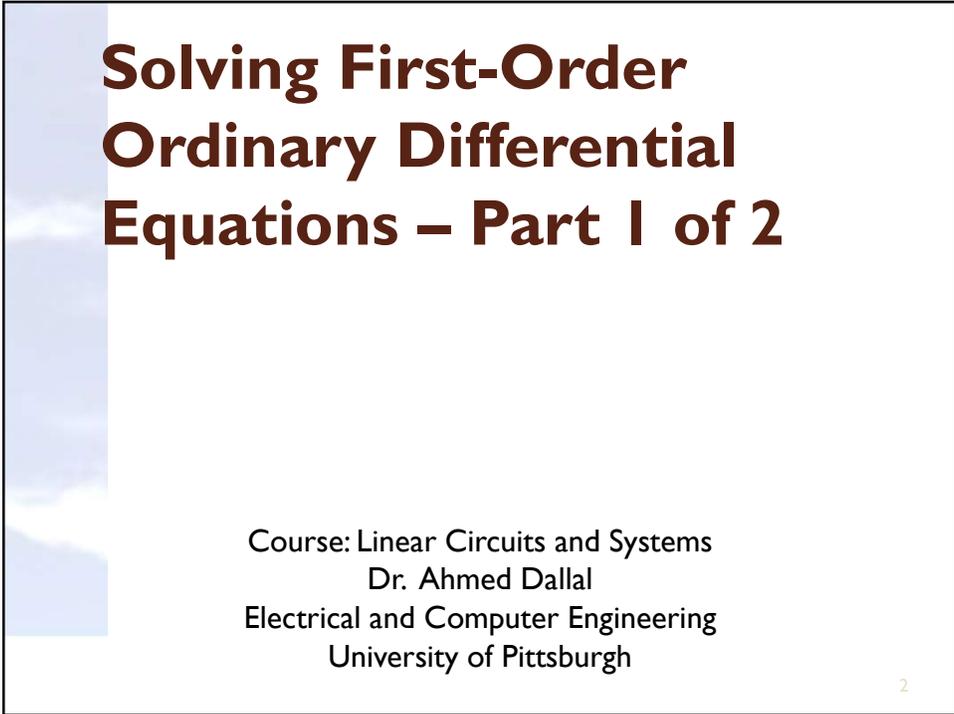




- Linear Circuits and Systems



Solving First-Order Ordinary Differential Equations – Part I of 2

Course: Linear Circuits and Systems
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1st Order Linear ODE

- The general form of a first-order linear ordinary differential equation with constant coefficients is given by

$$k_1 \frac{dy}{dt} + k_0 y = F(t)$$

- The general solution contains two parts

$$y = y_H + y_P$$

Homogenous Solution

- The homogeneous part of the solution y_H is that part of the solution that gives **zero** when substituted in the left-hand side of the ODE.

$$k_1 \frac{dy_H}{dt} + k_0 y_H = 0$$

Homogenous Solution

$$k_1 \frac{dy_H}{dt} + k_0 y_H = 0$$



Particular Solution

- The particular part of the solution y_P is that part of the solution that gives $F(t)$ when substituted for y in the ODE.
- Usually the particular solution is similar in form to $F(t)$.

Particular Solution

$F(t)$	$y_P(t)$
a_0	b_0
$a_0 + a_1t + a_2t^2$	$b_0 + b_1t + b_2t^2$
e^{at}	Ae^{ax}
$\sin(bt)$	$A\sin(bt) + B\cos(bt)$
$e^{at}\sin(bt)$	$e^{at}(A\sin(bt) + B\cos(bt))$
$\cos(bt)$	$A\sin(bt) + B\cos(bt)$
$e^{at}\cos(bt)$	$e^{at}(A\sin(bt) + B\cos(bt))$

Particular Solution

$F(x)$	$y_P(x)$
a_0	b_0
$a_0 + a_1x + a_2x^2$	$b_0 + b_1x + b_2x^2$
e^{ax}	Ae^{ax}
$\sin(bx)$	$A\sin(bx) + B\cos(bx)$
$e^{ax}\sin(bx)$	$e^{ax}(A\sin(bx) + B\cos(bx))$
$\cos(bx)$	$A\sin(bx) + B\cos(bx)$
$e^{ax}\cos(bx)$	$e^{ax}(A\sin(bx) + B\cos(bx))$

Conclusion



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