Dept. Electrical and Computer Engineering
The University of British Columbia
EECE560 Network Analysis and Simulation January 2021
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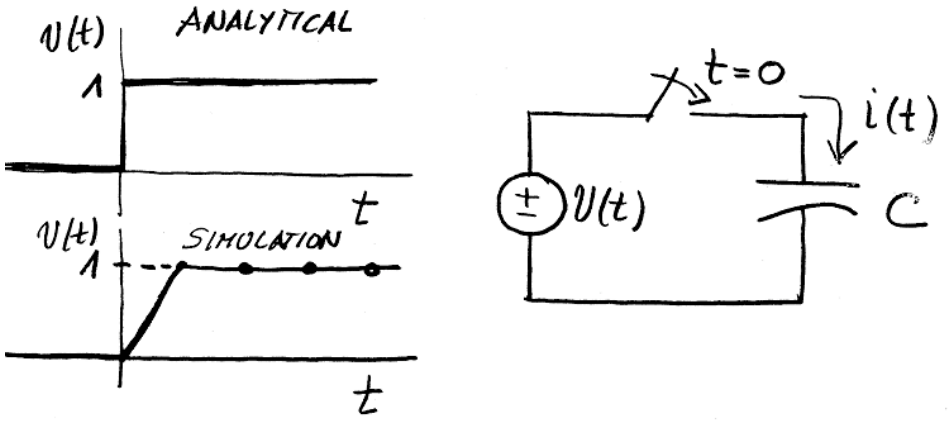
ASSIGNMENT No. 7

Due Date: 2 April 2021

Numerical Oscillations of Discretization Rules

A simple way to analyze the problem of numerical oscillations in discrete time simulation is to solve an elementary lossless first order system (inductance or capacitance) when the state variable of the component is suddenly changed. The circuit below considers the case of a sudden voltage step applied to a capacitance.



1. Determine the step by step solution for the current in the capacitor using the following discretization rules:
   (a) Trapezoidal
   (b) Backward Euler
   (c) Forward Euler
   (d) Gear's Second Order
2. Explain the observed behaviour in terms of the poles of the z^{-1} transfer function.
3. Comment on the suitability of the rules for transients simulation.
4. Repeat 1(a) and 1(b) for the ramp function below and comment on the results.