Circuit Simulation Project

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Title of Proposed Work :

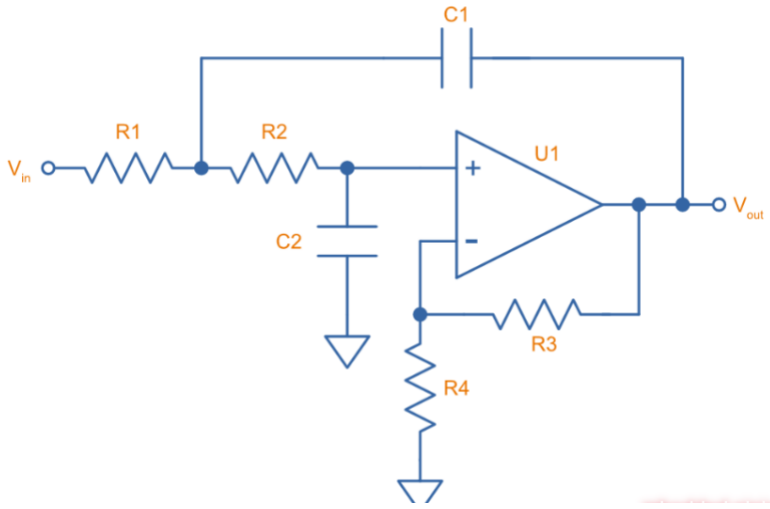
Design and Realization of a Ripple-Controlled Active Chebyshev Filter using Sallen-Key Topology in eSim

Problem Statement:

Accurate signal filtering is essential in communication and instrumentation systems. Traditional Butterworth filters provide a flat passband but have a slower roll-off. Chebyshev filters allow a small ripple in the passband to achieve a sharper cutoff and improved selectivity. This project focuses on implementing a 2nd-order Chebyshev Active Low-Pass Filter using the Sallen-Key topology in eSim, targeting stable performance, controlled ripple, and enhanced frequency response.

Implementation Plan:

- MoModel the operational amplifier (LM741/LM358) in eSim as the active element.
- Design the Sallen-Key configuration with calculated R and C values for ~1 kHz cutoff and 0.5 dB ripple.
- Connect input source, feedback, and filter components in eSim schematic.
- Perform AC analysis in NgSpice to observe passband ripple and sharper roll-off.
- Adjust component values to fine-tune cutoff frequency and response.



Reference:

[1] A. S. Sedra and K. C. Smith, *Microelectronic Circuits*, 7th ed. New York, NY, USA: Oxford University Press, 2015.

[2] "Sallen-Key Low Pass Filter," *Electronics-Tutorials.ws*. [Online]. Available: https://www.electronics-tutorials.ws/filter/sallen-key-filter.html