

E4.16 Current-mode Analogue Signal Processing

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Lectures : Wednesday 9:00, Friday 11:00

Reference: Toumazou, C., Lidgey, F.J. and Haigh, D. G.,(Eds), "Analogue IC Design: the current-mode approach", IEE, Peter Peregrinus, London, April 1990. ISBN 0 86341 297 1

Your notes, Handouts

Aims:

This course aims to introduce current-mode analog signal processing as an alternative to the more conventional voltage mode signal processing. The benefits to be gained from operating with currents as the signal parameter rather than voltages will be discussed, including high frequency operation and wide dynamic range under low power supply voltages. Various transistor-level current-mode techniques suitable for fully-integrated systems will be introduced.

Learning Outcomes:

Understand the motivation for operating in current-mode rather than voltage mode. Describe current-mode architectures for various analog signal processing functions including amplification and sampled data and continuous-time filtering. Describe circuit techniques such as the current-conveyor and current-feedback opamp where traditional voltage-mode applications can also be enhanced by exploiting current-mode techniques.

Syllabus:

Current-mode vs. voltage mode processing; supply-current sensing, current conveyors, current-mode instrumentation amplifiers. Adjoint networks. Translinear circuits. High-performance amplifier architectures, current-feedback opamps. Current-mode filters; switched current processing, translinear/log domain filters. Current-mode instrumentation amplifiers and precision rectifiers; switched-current techniques; problems with traditional current output circuits; basic current-conveyor applications.

Brochure:

The analogue signal processing industry is receiving a tremendous boost from the design and application of so-called "current-mode" IC design. Advances in process technology, such as the development of true complementary BJT technology, has brought about new circuit and system techniques which successfully exploit current as the main operating parameter. In this course we will review state-of-the-art current-mode techniques including current-conveyors, log-domain processing, current-mode filters, switched-current processing and current-feedback amplifier design and applications. The key application area of this technology is high frequency wireless and radio frequency design. This will, as far as we are aware, be the first undergraduate course specifically devoted to this emerging and important area of electronics.