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A Method for the Design of Stable Lateral Inhibition Networks that is Robust in the Presence of Circuit Parasiti

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Abstract:

In the analog VLSI implementation of neural systems, it is sometimes convenient to build lateral inhibition networks by using a

locally connected on-chip resistive grid. A serious problem of unwanted spontaneous oscillation often arises with these circuits and renders them

unusable in practice. This paper reports a design approach that guarantees such a system will be stable, even though the

values of designed elements and parasitic elements in the resistive grid may be unknown. The method is based on a

rigorous, somewhat novel mathematical analysis using Tellegen's theorem and the idea of Popov multipliers from control theory. It is thoroughly

practical because the criteria are local in the sense that no overall analysis of the interconnected system is required, empirical

in the sense that they involve only measurable frequency response data on the individual cells, and robust in the sense

that unmodelled parasitic resistances and capacitances in the inter(cid:173) connection network cannot affect the

analysis. I.

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