Ermentrout, Bard; **Pascal, Matthew**; **Gutkin, Boris**

The effects of spike frequency adaptation and negative feeback on the synchronization of neural oscillators. (English) Zbl 0963.68647

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Summary: There are several different biophysical mechanisms for spike frequency adaptation observed in recordings from cortical neurons. The two most commonly used in modeling studies are a calcium-dependent potassium current I_{ahp} and a slow voltage-dependent potassium current, I_m. We show that both of these have strong effects on the synchronization properties of excitatorily coupled neurons. Furthermore, we show that the reasons for these effects are different. We show through an analysis of some standard models, that the M-current adaptation alters the mechanism for repetitive firing, while the afterhyperpolarization adaptation works via shunting the incoming synapses. This latter mechanism applies with a network that has recurrent inhibition. The shunting behavior is captured in a simple two-variable reduced model that arises near certain types of bifurcations. A one-dimensional map is derived from the simplified model.

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68U99 Computing methodologies and applications
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