Unequal Pumping - Investigations

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1 Zero detuning

Investigation of the stability boundaries for unequal pumping using

$$|\eta| = \frac{\alpha_H (Q_A + Q_B - 2)(1 - q^2)^{3/2}}{2\tau_p [(Q_A + Q_B)(1 - q^2) + 2q^2]}, \tag{1}$$

delimiting in-phase stable solutions and

$$|\eta| = \frac{[(Q_A + Q_B)(1 - q^2) + 2q^2](1 - q^2)^{1/2}}{4\alpha_H \tau_N}, \tag{2}$$

for the anti-phase solutions, where

$$q = \frac{Q_A - Q_B}{Q_A + Q_B - 2}.$$

In the limiting case $Q_A = Q_B = Q$, these reduce to the Wingful-Wang expressions

$$|\eta| = \frac{\alpha_H (Q - 1)}{2\tau_p Q} \tag{3}$$

and

$$|\eta| = \frac{Q}{4\alpha_H \tau_N}, \tag{4}$$

respectively.

In the following, we allow η and Q_A to vary keeping the remaining parameters listing in Table 1 fixed. For these calculations, we choose $Q_B = 20$.

Parameter	Value
alpha	5
cavity loss rate (1/ns)	200
carrier loss rate (1/ns)	1
coupling (equal)	varied
coupling phase (rad)	0
detuning (rad/ns)	0
pump (A)	varied
pump (B)	20

Axis	Parameter	Start	End
X	pump (A)	2	40
Y	coupling (equal)	1	2000

Table 1: Stability map calculation data (set 1).

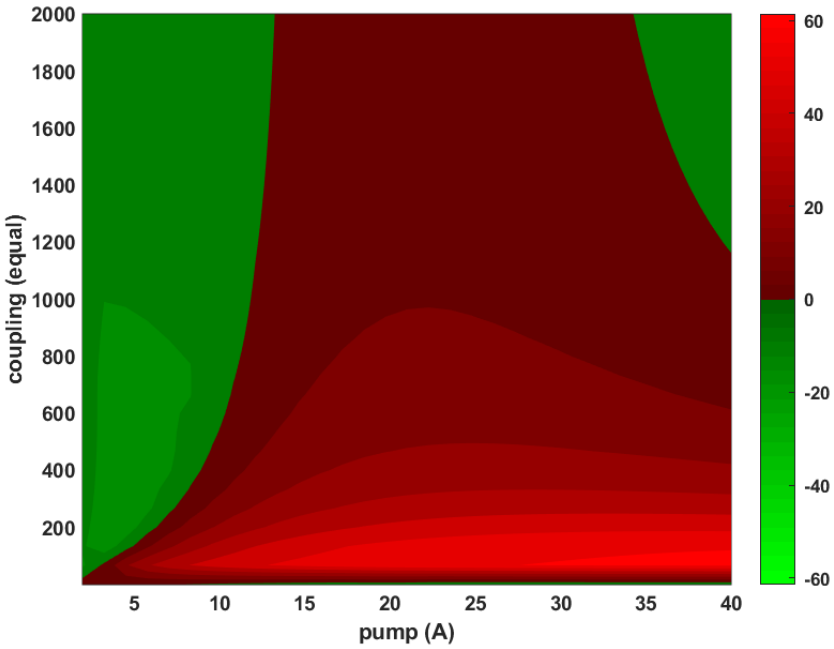

Figure 1: Stability map for parameters in Table 1 for *anti-phase* solutions on a large scale (there are no expressions applicable for this region).

Axis	Parameter	Start	End
X	pump (A)	2	40
Y	coupling (equal)	0.01	4

Table 2: Small scale range for η.

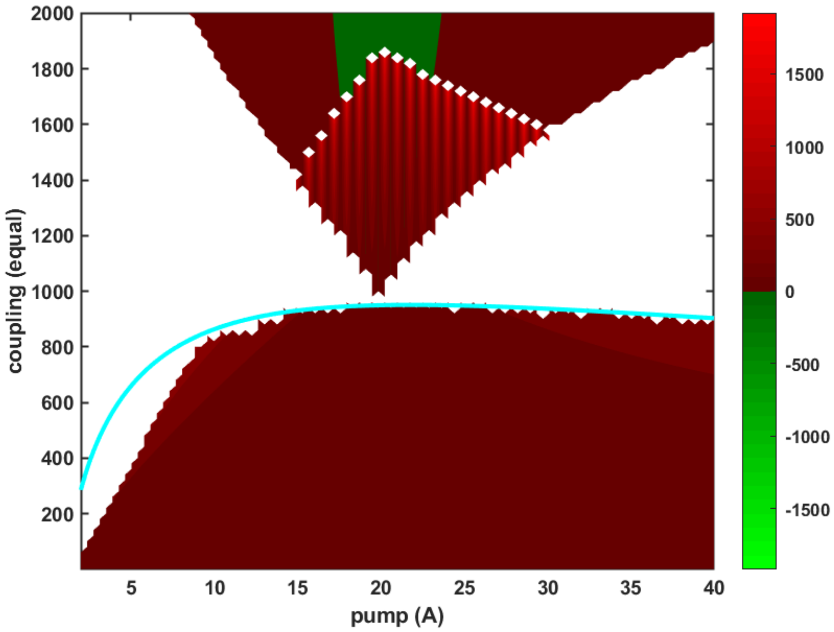

Figure 2: Stability map for parameters in Table 1 for *in-phase* solutions. The cyan curve shows Eq. (1). Note that no stable, in-phase solutions were found in this region by the stability mapper.

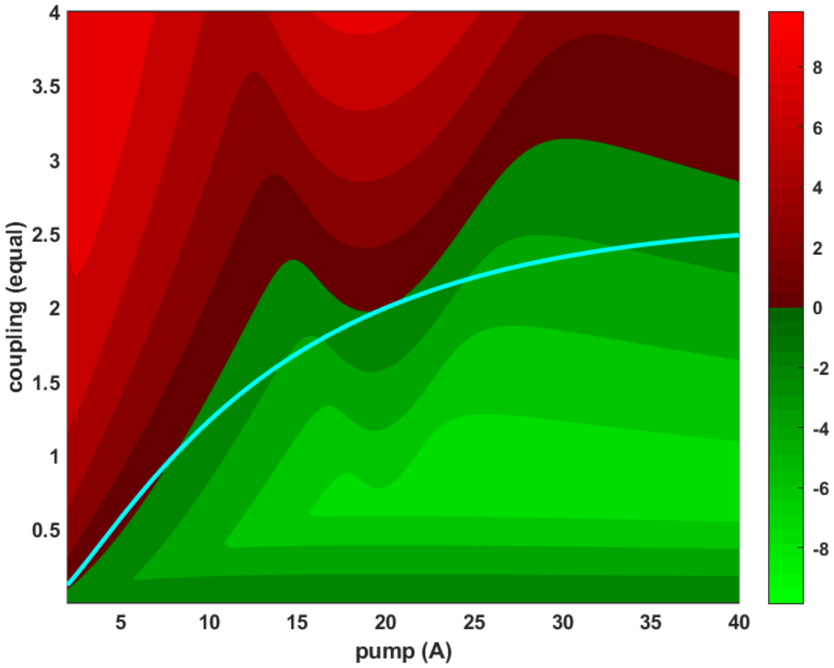

Figure 3: Stability map for ranges in Table 2 for *anti-phase* solutions. The cyan curve is for Eq. (2). The curve bears little relation to the map, although both coincide at $Q_A = 20$ when Eq. (2) reduces to the Wingful-Wang expression Eq. (4).