Equations to a sparsely coupled theta model with synaptic depression and synaptic conductance

$$i = 1, 2, 3, ..., N \qquad 0 \leq \theta < 2\pi$$

$$\dot{\theta}_i = 1 - \cos(\theta_i) + I_i\left[1 + \cos(\theta_i)\right]$$
$$\dot{m}_i = -\frac{m_i}{\tau_m}$$
$$\dot{n}_i = -\frac{n_i}{\tau_n} + \alpha m_i(1 - n_i)$$
$$\dot{s}_i = -\frac{s_i}{\tau_s}$$

where,

$$y_i = 1 - n_i$$
$$I_i = I_0 + d\sum_j s_j y_j$$