

Weight independence of I/F and A/I

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We know HOU and GUT as follows:

$$\frac{dHOU}{dt} = F - I \quad (1)$$

$$\frac{dGUT}{dt} = I - A \quad (2)$$

With the following:

$$F = f \times BO^b \times \frac{FC}{FC + kf} \quad (3)$$

$$I = i \times BO^b \times \frac{HOU}{HOU + ki \times BO^b} \quad (4)$$

$$A = a \times BO^b \times \frac{GUT}{GUT + ka \times BO^b} \quad (5)$$

We pose u and v as follows:

$$u = \frac{HOU}{BO^b} \quad (6)$$

$$v = \frac{GUT}{BO^b} \quad (7)$$

So:

$$I = \frac{i \times u \times BO^b}{u + ki} \quad (8)$$

$$A = \frac{a \times v \times BO^b}{v + ka} \quad (9)$$

And so, when FC is constant, equations 1 and 2 can be written as follows:

$$\frac{dHOU}{dt} = BO^b \times \left[C - \frac{i \times u}{u + ki} \right] \quad (10)$$

$$\frac{dGUT}{dt} = BO^b \times \left[\frac{i \times u}{u + ki} - \frac{a \times v}{v + ka} \right] \quad (11)$$

with the constant C as follows:

$$C = f \times \frac{FC}{FC + kf} \quad (12)$$

So:

$$\frac{du}{dt} = \frac{1}{BO^b} \times \frac{dHOU}{dt} \quad (13)$$

$$\frac{du}{dt} = C - \frac{i \times u}{u + ki} \quad (14)$$

$$\frac{dv}{dt} = \frac{1}{BO^b} \times \frac{dGUT}{dt} \quad (15)$$

$$\frac{dv}{dt} = \frac{i \times u}{u + ki} - \frac{a \times v}{v + ka} \quad (16)$$

Because those differential equations do not explicitly depend on BO, solutions $u(t)$ and $v(t)$ cannot depend on BO, so

$$\frac{\partial u}{\partial BO} = 0 \quad \text{and} \quad \frac{\partial v}{\partial BO} = 0 \quad (17)$$

I/F and A/I can be written as follows:

$$\frac{I}{F} = \frac{i \times u}{u + ki} \quad (18)$$

$$\frac{A}{I} = \frac{a \times v}{v + ka} \quad (19)$$

Because those equations only depend on u and v ,

$$\frac{\partial \frac{I}{F}}{\partial BO} = 0 \quad (20)$$

$$\frac{\partial \frac{A}{I}}{\partial BO} = 0 \quad (21)$$