

Umlaufrädergetriebe

1 Übersetzungen/Drehzahlverhältnisse

1.1 Standübersetzung:

$$i_0 = \frac{\omega_{10} - \omega_{S0}}{\omega_{20} - \omega_{S0}}$$

mit

ω_{10}	absolute Winkelgeschwindigkeit des Zentralrades
ω_{20}	absolute Winkelgeschwindigkeit des Hohlrades
ω_{S0}	Winkelgeschwindigkeit des Steges

1.2 Drehzahlverhältnisse bei 3-welligen Getrieben:

$\frac{\omega_{10}}{\omega_{20}} = i_0 + (1 - i_0) \frac{\omega_{S0}}{\omega_{20}}$	$\frac{\omega_{20}}{\omega_{10}} = \frac{1}{i_0} + \left(1 - \frac{1}{i_0}\right) \frac{\omega_{S0}}{\omega_{10}}$
$\frac{\omega_{10}}{\omega_{S0}} = (1 - i_0) + i_0 \frac{\omega_{20}}{\omega_{S0}}$	$\frac{\omega_{S0}}{\omega_{10}} = \frac{\frac{\omega_{20}}{\omega_{10}} i_0 - 1}{i_0 - 1}$
$\frac{\omega_{20}}{\omega_{S0}} = \frac{\frac{\omega_{10}}{\omega_{S0}} - (1 - i_0)}{i_0}$	$\frac{\omega_{S0}}{\omega_{20}} = \frac{i_0 - \frac{\omega_{10}}{\omega_{20}}}{i_0 - 1}$

1.3 Drehzahlverhältnisse bei 2-welligen Getrieben:

	$\omega_{S0} = 0$
$\frac{\omega_{10}}{\omega_{20}} = i_{12} = i_0$	$\frac{\omega_{20}}{\omega_{10}} = i_{21} = \frac{1}{i_0}$
	$\omega_{20} = 0$
$\frac{\omega_{10}}{\omega_{S0}} = i_{1S} = 1 - i_0$	$\frac{\omega_{S0}}{\omega_{10}} = i_{S1} = \frac{1}{1 - i_0}$
	$\omega_{10} = 0$
$\frac{\omega_{20}}{\omega_{S0}} = i_{2S} = \frac{i_0 - 1}{i_0}$	$\frac{\omega_{S0}}{\omega_{20}} = i_{S2} = \frac{i_0}{i_0 - 1}$

2 Wirkungsgrade

2.1 Wirkungsgrade bei 3-welligen Getrieben:

$$\eta_{1 \leftarrow 2}^S = \eta_0^W + (1 - \eta_0^W) \frac{\omega_{S0}}{\omega_{10}}$$

$$\eta_{S \leftarrow 1}^2 = \frac{\eta_0^W (i_0 - 1) + (\eta_0^W - 1) \frac{\omega_{10}}{\omega_{S0}}}{i_0 * \eta_0^W - 1}$$

$$\eta_{2 \leftarrow 1}^S = \frac{1}{\eta_0^W} + \left(1 - \frac{1}{\eta_0^W}\right) \frac{\omega_{S0}}{\omega_{20}}$$

2.2 Wirkungsgrade bei 2-welligen Getrieben

$$\omega_{10} = 0$$

$$\eta_{2-S} = \frac{i_0 - \frac{1}{\eta_0^W}}{i_0 - 1}$$

$$\eta_{S-2} = \frac{i_0 - 1}{i_0 - \frac{1}{\eta_0^W}}$$

$$\omega_{20} = 0$$

$$\eta_{1-S} = \frac{1 - i_0 * \eta_0^W}{1 - i_0}$$

$$\eta_{S-1} = \frac{1 - i_0}{1 - i_0 * \eta_0^W}$$

3 Drehmomentverhältnisse/Leistungen

3.1 Drehmomentverhältnisse:

$$W = \frac{T_1 * (\omega_{10} - \omega_{S0})}{|T_1 * (\omega_{10} - \omega_{S0})|}$$

$$\frac{T_2}{T_1} = -i_0 * \eta_0^W$$

$$\frac{T_S}{T_1} = i_0 * \eta_0^W - 1$$

$$\frac{T_S}{T_2} = \frac{1}{i_0 * \eta_0^W} - 1$$

3.2 Leistungen:

$$P_S = 0 + P_{K3} = 0 + T_S * \omega_{S0} = T_S * \omega_{S0}$$

$$P_1 = P_{GW1} + P_{K1} = T_1 * (\omega_{10} - \omega_{S0}) + T_1 * \omega_{S0} = T_1 * \omega_{10}$$

$$P_2 = P_{GW2} + P_{K2} = T_2 * (\omega_{10} - \omega_{S0}) + T_2 * \omega_{S0} = T_2 * \omega_{20}$$