共振器の光エネルギーの立ち上がり，利得媒質の反転分布の立ち上がりに時間的ずれがあるため，過渡的な振動減少が生じる。これが緩和発信。

$$
\begin{aligned}
N_1' &= R - \frac{1 + Bt_cN_1}{Bt_c\tau} - \frac{RBt_c\tau - 1}{Bt_c\tau} - \frac{\rho_1}{t_c} - \frac{RBt_c\tau - 1}{\tau}N_1 \\
&= R - \frac{Bt_cN_1 + RBt_c\tau}{Bt_c\tau} - \frac{\rho_1}{t_c} - \frac{RBt_c\tau - 1}{\tau}N_1 \\
&= R - \frac{N_1 + R\tau}{\tau} - \frac{\rho_1}{t_c} - \frac{RBt_c\tau - 1}{\tau}N_1 \\
&= -\frac{N_1}{\tau} - \frac{\rho_1}{t_c} - \frac{RBt_c\tau - 1}{\tau}N_1 \\
&= -\frac{RBt_c\tau}{\tau}N_1 - \frac{\rho_1}{t_c} \\
&= -RBt_cN_1 - \frac{\rho_1}{t_c} \\
\rho_1' &= -\frac{\frac{RBt_c\tau - 1}{B\tau} + \rho_1}{t_c} + \frac{RBt_c\tau - 1}{Bt_c\tau} + \frac{\rho_1}{t_c} + \frac{RBt_c\tau - 1}{\tau}N_1 \\
&= -\frac{RBt_c\tau - 1 + B\tau\rho_1}{Bt_c\tau} + \frac{RBt_c\tau - 1}{Bt_c\tau} + \frac{\rho_1}{t_c} + \frac{RBt_c\tau - 1}{\tau}N_1 \\
&= -\frac{B\tau\rho_1}{Bt_c\tau} + \frac{\rho_1}{t_c} + \frac{RBt_c\tau - 1}{\tau}N_1 \\
&= -\frac{\rho_1}{t_c} + \frac{\rho_1}{t_c} + \frac{RBt_c\tau - 1}{\tau}N_1 \\
&= \frac{RBt_c\tau - 1}{\tau}N_1 \\
N_1 &= \frac{\tau}{RBt_c\tau - 1}\rho_1'
\end{aligned}
$$

$$
\rho_1'' = \frac{RBt_c\tau - 1}{\tau}N_1' \Longleftrightarrow N_1' = \frac{\tau}{RBt_c\tau - 1}\rho_1''
$$

$$
\begin{aligned}
\frac{\tau}{RBt_c\tau - 1}\rho_1'' &= -RBt_cN_1 - \frac{\rho_1}{t_c} \\
\frac{\tau}{RBt_c\tau - 1}\rho_1'' &= -RBt_c\frac{\tau}{RBt_c\tau - 1}\rho_1' - \frac{\rho_1}{t_c} \\
\frac{\tau}{r - 1}\rho_1'' &= -\frac{r}{r - 1}\rho_1' - \frac{\rho_1}{t_c} \\
0 &= \frac{\tau}{r - 1}\rho_1'' + \frac{r}{r - 1}\rho_1' + \frac{\rho_1}{t_c}
\end{aligned}
$$

$\rho = Ae^{pt}$ とすると

$$
\begin{aligned}
0 &= \frac{\tau}{r-1}Ap^2e^{pt} + \frac{r}{r-1}Ape^{pt} + \frac{1}{t_c}Ae^{pt} \\
0 &= \frac{\tau}{r-1}p^2 + \frac{r}{r-1}p + \frac{1}{t_c} \\
0 &= p^2 + \frac{r}{\tau}p + \frac{r-1}{t_c\tau} \\
p &= \frac{-b \pm \sqrt{b^2-4ac}}{2a} \\
&= \frac{-\frac{r}{\tau} \pm \sqrt{\frac{r^2}{\tau^2} - 4\frac{r-1}{t_c\tau}}}{2} \\
&= -\frac{r}{2\tau} \pm \sqrt{\left(\frac{r}{2\tau}\right)^2 - \frac{r-1}{t_c\tau}}
\end{aligned}
$$

$\frac{r-1}{t_c\tau} \gg \left(\frac{r}{2\tau}\right)^2$

$$
p = -\frac{r}{2\tau} \pm i\sqrt{\frac{r-1}{t_c\tau}}
$$