To implement Chebyshev acceleration cheaply, use the 3 term recurrence relation

$$T_m(x) = 2xT_{m-1}(x) - T_{m-2}(x) \tag{1}$$

This means we need to save and combine only 3 vectors, y_m, y_{m-1} and y_{m-2} and not all previous $x_,$.

To see how this works let

$$\mu_m \equiv \frac{1}{T_m(1/\rho)} \tag{2}$$

so

$$P_m(R) = \mu_m T_m\left(\frac{R}{\rho}\right)$$

and

$$\frac{1}{\mu_m} = \frac{2}{\rho\mu_{m-1}} - \frac{1}{\mu_{m-2}}$$

by the 3 term recurrence in Eqn 1. Therefore

$$\begin{aligned}
y_m - x &= P_m(R)(x_0 - x) \\
&= \mu_m T_m\left(\frac{R}{\rho}\right)(x_0 - x) \\
&= \mu_m\left[2\frac{R}{\rho}T_{m-1}\left(\frac{R}{\rho}\right)(x_0 - x)\right. \\
&\quad \left. -T_{m-2}\left(\frac{R}{\rho}\right)(x_0 - x)\right] \\
&= \mu_m\left[2\frac{R}{\rho}\frac{P_{m-1}\left(\frac{R}{\rho}\right)(x_0 - x)}{\mu_{m-1}} - \frac{P_{m-2}\left(\frac{R}{\rho}\right)(x_0 - x)}{\mu_{m-2}}\right] \\
&= \mu_m\left[2\frac{R}{\rho}\frac{y_{m-1} - x}{\mu_{m-1}} - \frac{y_{m-2} - x}{\mu_{m-2}}\right]
\end{aligned}$$

or

$$y_m = \frac{2\mu_m}{\mu_{m-1}}\frac{R}{\rho}y_{m-1} - \frac{\mu_m}{\mu_{m-2}}y_{m-2} + dm$$

where

$$\begin{aligned}
dm &= x - \frac{2\mu_m}{\mu_{m-1}}\left(\frac{R}{\rho}\right)x + \frac{\mu_m}{\mu_{m-2}}x \\
&= x - \frac{2\mu_m}{\mu_{m-1}}\left(\frac{x - c}{\rho}\right) + \frac{\mu_m}{\mu_{m-2}}x \\
&= \mu_m\left(\frac{1}{\mu_m} - \frac{2}{\rho\mu_{m-1}} + \frac{1}{\mu_{m-2}}\right)x + \frac{2\mu_m}{\rho\mu_{m-1}}c \\
&= \frac{2\mu_m}{\rho\mu_{m-1}}c
\end{aligned}$$

This yields the algorithm

ALGORITHM: Chebyshev acceleration of $x_{i+1} = Rx_i + c$.
$\mu_0 = 1$; $\mu_1 = \rho$; $y_0 = x_0$; $y_1 = Rx_0 + c$

`for m=2,3`...

$$\begin{aligned}
\mu_m &= \frac{1}{\left(\frac{2}{\rho\mu_{m-1}} - \frac{1}{\mu_{m-2}}\right)} \\
y_m &= \frac{2\mu_m}{\rho\mu_{m-1}} R y_{m-1} - \frac{\mu_m}{\mu_{m-2}} y_{m-2} + \frac{2\mu_m}{\rho\mu_{m-1}} c
\end{aligned}$$

`end for`.