Pressure spatial superposition principle @ model

Implication that pressure $p(t,\mathbf{r})$ at any point $\mathbf{r}$ of a porous reservoir is a linear sum of pressure responses $\delta p_k(t,\mathbf{r})$ to individual rate variations $q_k(t)$ in all wells connected to this reservoir:

(1) $$p(t,\mathbf{r}) = p_i + \sum_k \delta p_k(t,\mathbf{r}) = p_i + \sum_k \int_0^t p_{uk}(t-\tau,\mathbf{r})\, dq_k(\tau)$$

In case reservoir point $\mathbf{r}$ defines location of m-well the superposition principle can be rewritten as:

(2) $$p_m(t) = p_{mi} + \sum_k \delta p_{mk}(t) = p_{mi} + \sum_k \int_0^t p_{umk}(t-\tau)\, dq_k(\tau) = p_{mi} + \int_0^t p_{umm}(t-\tau)\, dq_m(\tau) + \sum_{k\neq m} \int_0^t p_{umk}(t-\tau)\, dq_k(\tau)$$

where

p_{mi}	initial formation pressure in m-well
$\delta p_{mk}(t)$	specific component of m-well pressure variation caused by k-well flowrate history $q_k(t)$
$p_{umm}(\tau)$	bottomhole pressure response in m-well to unit-rate production in the same well (DTR)
$p_{umk}(\tau)$	bottomhole pressure in m-well to unit-rate production in k-well (CTR), $k \neq m$