

# Pressure pulse-code decomposition (PCD) @ model

Specific implementation of [pressure spatial decomposition](#) based on recognising the time pattern of flowrate variation pulse sequence in pressure response.

It constitutes the key interpretation procedure for [PCT](#).

The [decomposition](#) algorithm is based on the minimisation of correlation functional  $X$  between generating well pressure variation  $\delta p_G(t)$  and pressure trend  $p_{R,tr}(t)$  at receiving well after deducting the simulated pressure pulse-code response:

$$\begin{aligned} (1) \quad X[p_{uGG}] &= \langle |p_{G,tr}(t)|, |\delta p_G(t)| \rangle \rightarrow \min \\ (2) \quad X[p_{uGR}] &= \langle |p_{R,tr}(t)|, |\delta p_R(t)| \rangle \rightarrow \min \end{aligned}$$

where

$$\begin{aligned} (3) \quad p_G(t) &= p_{G,tr}(t) - \delta p_G(t), \quad \delta p_G(t) = \int_0^t p_{uGG}(t - \tau) dq_G(\tau) \\ (4) \quad p_R(t) &= p_{R,tr}(t) - \delta p_R(t), \quad \delta p_R(t) = \int_0^t p_{uGR}(t - \tau) dq_G(\tau) \end{aligned}$$

The generator's flowrate history  $q_G(t)$ , generator's wellbore pressure history  $p_G(t)$  and receiver's wellbore pressure history  $p_R(t)$  are assumed to be known for the whole period of the test.

The result of [decomposition](#) is the set of the unit-rate transient responses, [DTRs](#)  $p_{uGG}(\tau)$  and [CTRs](#)  $p_{uGR}(\tau)$ , which characterise reservoir properties round generator and between generator and receiver.

The pressure trends at generator  $p_{G,tr}(t)$  and receiver  $p_{R,tr}(t)$  may have unknown origin but in order for [decomposition](#) to work they should have minimum correlation with generating well flowrate variation  $q_G(t)$ . In terms of spectral analysis this means that pressure trend spectrum contains minimum overlap with spectrum of flowrate variation  $q_G(t)$  at generator.

This particularly means that pressure trends at generating and receiving wells may contain:

- low frequencies (created by monotonous activities of distant wells), which are lower than frequency range of the generating well flow variation  $q_G(t)$

or

- high frequencies (created by lift instability at generating/receiving well), which are higher than frequency range of the generating well flow variation  $q_G(t)$

If pressure trends contain components correlated with  $q_G(t)$  (for example receiving well or distant wells have been synchronously varying the rates with generating well) then [decomposition](#) is not unique and should not be considered.

## See Also

