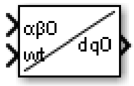
Perform transformation from αβ0 stationary reference frame to dq0 rotating reference frame or the inverse

Library

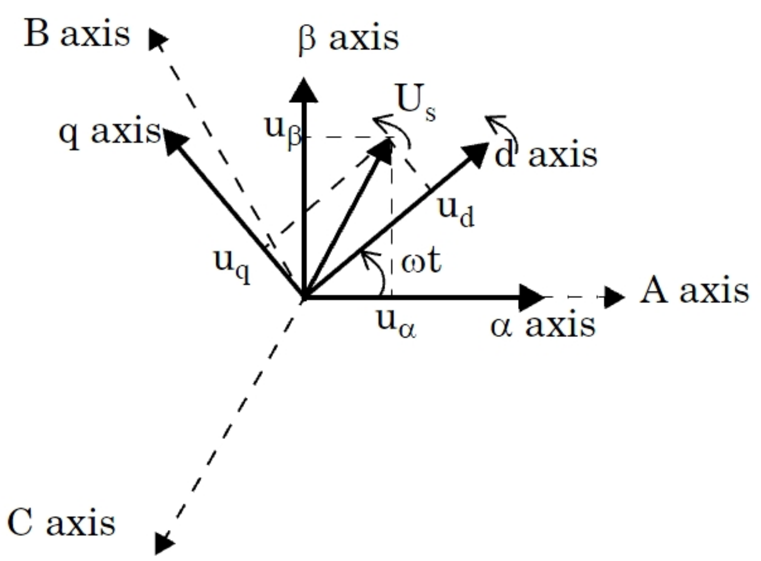
Control and Measurements/Transformations

Description



The Alpha-Beta-Zero to dq0 block performs a transformation of αβ0 Clarke components in a fixed reference frame to dq0 Park components in a rotating reference frame.

The dq0 to Alpha-Beta-Zero block performs a transformation of dq0 Park components in a rotating reference frame to αβ0 Clarke components in a fixed reference frame.



The block supports the two conventions used in the literature for Park transformation:

- Rotating frame aligned with A axis at t = 0. This type of Park transformation is also known as the cosinus-based Park transformation.
- Rotating frame aligned 90 degrees behind A axis. This type of Park transformation is also known as the sinus-based Park transformation. Use it in SimPowerSystems models of three-phase synchronous and asynchronous machines.

Knowing that the position of the rotating frame is given by ω.t (where ω represents the frame rotation speed), the αβ0 to dq0 transformation performs a −(ω.t) rotation on the space vector Us = uα + j· uβ. The homopolar or zero-sequence component remains unchanged.

Depending on the frame alignment at t = 0, the dq0 components are deduced from αβ0 components as follows:

When the rotating frame is aligned with A axis, the following relations are obtained:

$$U_s = u_d + j \cdot u_q = (u_a + j \cdot u_\beta) \cdot e^{-j\omega t}$$

$$\begin{bmatrix} u_d \\ u_q \\ u_0 \end{bmatrix} = \begin{bmatrix} \cos(\omega t) & \sin(\omega t) & 0 \\ -\sin(\omega t) & \cos(\omega t) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_a \\ u_\beta \\ u_0 \end{bmatrix}$$

The inverse transformation is given by

$$\begin{bmatrix} u_\alpha \\ u_\beta \\ u_0 \end{bmatrix} = \begin{bmatrix} \cos(\omega t) & -\sin(\omega t) & 0 \\ \sin(\omega t) & \cos(\omega t) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_d \\ uq \\ u_0 \end{bmatrix}$$

When the rotating frame is aligned 90 degrees behind A axis, the following relations are obtained:

$$U_s = u_d + j \cdot u_q = (u_\alpha + j \cdot u_\beta) \cdot e^{-j\left(\omega t - \frac{\pi}{2}\right)}$$

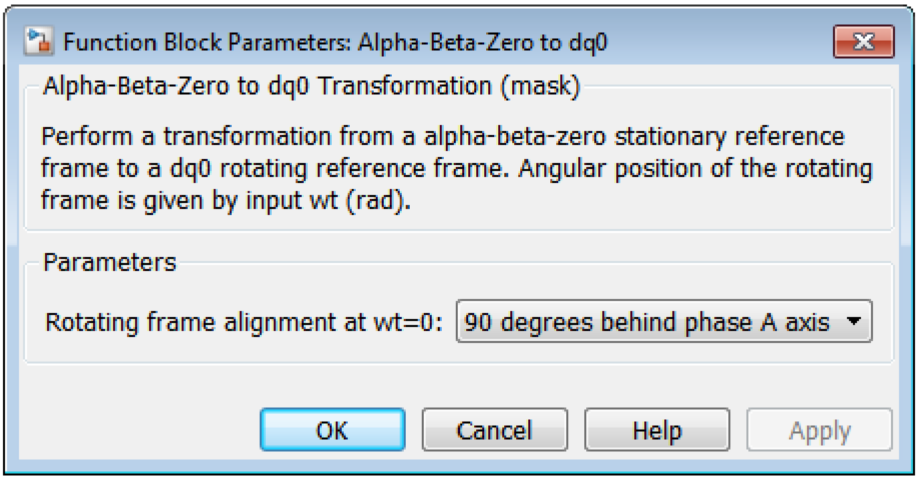
$$\begin{bmatrix} u_d \\ u_q \\ u_0 \end{bmatrix} = \begin{bmatrix} \sin(\omega t) & -\cos(\omega t) & 0 \\ \cos(\omega t) & \sin(\omega t) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_a \\ u_b \\ u_c \end{bmatrix}$$

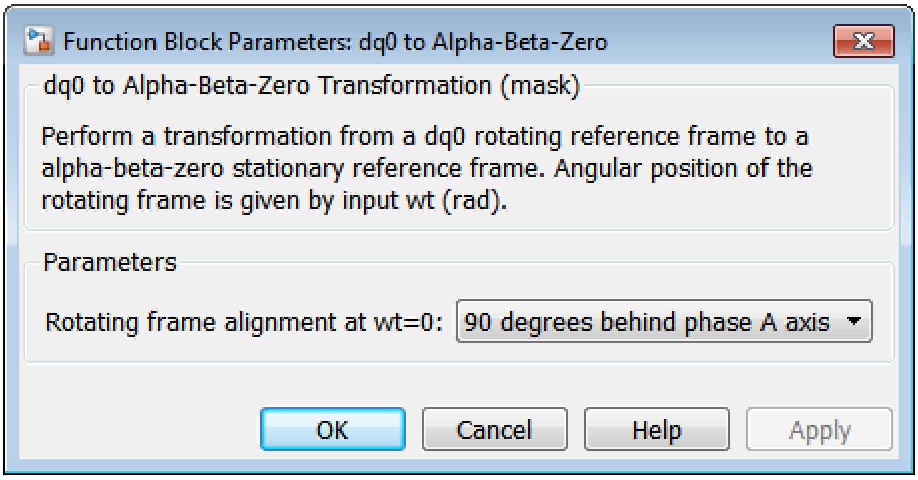
The inverse transformation is given by

$$u_\alpha + j \cdot u_\beta = (u_d + j \cdot u_q) \cdot e^{j\left(\omega t - \frac{\pi}{2}\right)}$$

The abc-to-Alpha-Beta-Zero transformation applied to a set of balanced three-phase sinusoidal quantities ua, ub, uc produces a space vector Us whose uα and uβ coordinates in a fixed reference frame vary sinusoidally with time. In contrast, the abc-to-dq0 transformation (Park transformation) applied to a set of balanced three-phase sinusoidal quantities ua, ub, uc produces a space vector Us whose ud and uq coordinates in a dq rotating reference frame stay constant.

Dialog Box and Parameters





Rotating frame alignment (at wt=0)

Select the alignment of rotating frame, when wt = 0, of the dq0 components of a three-phase balanced signal:

(positive-sequence magnitude = 1.0 pu; phase angle = 0 degree)

When you select `Aligned with phase A axis`, the dq0 components are d = 0, q = −1, and zero = 0.

When you select `90 degrees behind phase A axis`, the dq0 components are d = 1, q = 0, and zero = 0.

Inputs and Outputs

αβ0

The vectorized αβ0 signal.

`dq0`

The vectorized dq0 signal.

`wt`

The angular position, in radians, of the dq rotating frame relative to the stationary frame.

Example

The `power_Transformations` example shows various uses of blocks performing Clarke and Park transformations.

Introduced in R2013a