Abbreviations and symbols:

Notations

- $a_1$ parameter used in eqn. 7.1 (dimensionless)
- $a_2$ parameter used in eqn. 7.2 (dimensionless)
- $b_1$ parameter used in eqn. 7.1 (Pa$^{-1}$)
- $b_2$ parameter used in eqn. 7.2 (rad$^{-1}$ s)
- $A$ total membrane surface area (m$^2$)
- $C_0$ feed concentration (kg m$^{-3}$)
- $\bar{C}_m$ average concentration of polarized layer (kg m$^{-3}$)
- $C_p$ permeate concentration (kg m$^{-3}$)
- $e$ specific energy usage rate (W h L$^{-1}$)
- $\dot{E}$ total power consumption (W)
- $\dot{E}_{motor}$ power consumption by motor (W)
- $\dot{E}_{pump}$ power consumption by feed pump (W)
- $g$ acceleration due to gravity (=9.8 m s$^{-2}$)
- $G_k$ turbulent kinetic energy generation rate (kg m$^{-1}$ s$^{-3}$)
- $J$ permeate flux (m$^3$ m$^{-2}$ s$^{-1}$)
- $\langle J \rangle$ time weighted average flux (m$^3$ m$^{-2}$ s$^{-1}$)
- $\overline{J}$ average permeate flux (m$^3$ m$^{-2}$ s$^{-1}$)
- $J_{BT}$ back transport flux (m$^3$ m$^{-2}$ s$^{-1}$)
- $\eta_m$ mechanical efficiency of the pump
- $k_1$ constant used in eqn. 5.3 (W s rad$^{-1}$)
- $k$ constant used in eqn. 4.1 (W s rad$^{-1}$)
- $P_{m,pump}$ mechanical power supplied by the pump (W)
- $P_{h,pump}$ hydraulic power supplied by the pump (W)
- $Q$ feed flow rate (m$^3$ s$^{-1}$)
- $r$ radial coordinate (m)
- $r$ position vector (m)
- $Re$ Reynolds number (dimensionless)
\( R_m \) hydraulic resistance of the membrane (m\(^{-1}\))
\( R_{obs} \) observed rejection (dimensionless)
TMP transmembrane pressure (Pa)
\( V_r \) velocity relative to the frame of reference (m s\(^{-1}\))
\( V_o \) tangential velocity of the basket (m s\(^{-1}\))
\( y^+ \) dimensionless distance from the wall (dimensionless)

**Greek letters**

\( \delta \) thickness of the polarized layer (m)
\( \sigma \) reflection coefficient (dimensionless)
\( \rho \) density of feed solution (kg m\(^{-3}\))
\( \tau \) stress tensor (Pa)
\( \tau_m \) local membrane shear stress (Pa)
\( \pi \) osmotic pressure (Pa)
\( \Delta \pi \) osmotic pressure differential across the membrane (Pa)
\( \mu \) viscosity of the feed (Pa s)
\( \eta \) pump efficiency (dimensionless)
\( \Omega \) rotational speed of the basket (rad s\(^{-1}\))

**Subscript**

Actual actual TMP acting across the membrane for which a steady state flux can be obtained from RFMM.
m membrane
obs observed
p permeate
r retentate
Req required pressure to obtain steady state permeate flux from RFMM, which is equal to TFMM
reg regenerated
s steady