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# Appendix: Biomechanical parameters definition

## Spatio-temporal parameters

**Stroke:** propulsion cycle.

**Push phase:** phase of a propulsion cycle during which the hand pushes on the handrim to propel the manual wheelchair.

**Recovery phase:** phase of a propulsion cycle during which the hand is not in contact with the handrim.

**Contact angle:** angle distance travelled by the hand on the handrim during the push phase.

**Push time:** duration of a push phase.

**Recovery time:** duration of a recovery phase.

**Cycle time:** duration of a propulsion cycle.

**Cycle frequency:** inverse of average cycle time.

**Speed:** average speed of the manual wheelchair or average simulated speed of the manual wheelchair (on a roller ergometer or treadmill).

## Kinematics

**Joint angle:** angle between two skeletal segments.

## Kinetics

**Rate of rise:** represents the initial impact load on the pushrim. It has multiple definitions:

- Maximum value of the derivative of the resultant force with respect to time during the first third of the stroke (as defined in Koontz et al., 2005):  $RoR = \max_{0 \leq t \leq \frac{T}{3}} \frac{dF_r}{dt}$ , where  $RoR$

is the Rate of Rise,  $t$  time,  $T$  the duration of the stroke, and  $F_r$  the resultant force applied to the handrim.

- Peak of the resultant force divided by the time to reach it since the beginning of the stroke (present in the literature, but not in our reviewed studies):  $RoR = \frac{\widehat{F}_r}{T_{peak}}$ , where  $RoR$  is the Rate of Rise,  $\widehat{F}_r$  the peak of the resultant force applied at the handrim, and  $T_{peak}$  the time to reach  $\widehat{F}_r$ .

**Handrim forces:** forces applied to the handrim by the hand.

**Fraction of effective force:** or mechanical effective force, represents the ratio between the forces useful to turn the rear wheel and the total force applied to the handrim. It has multiple definitions:

- Division of the square tangential force by the square resultant force (used in most of the reviewed studies):  $FEF = \frac{F_t^2}{F_r^2}$ , where  $FEF$  is the Fraction of Effective Force,  $F_t$  the tangential force applied to the handrim, and  $F_r$  the resultant force applied to the handrim.
- Propulsion moment squared divided by the handrim radius squared, all divided by the resultant force on the handrim squared:  $FEF = \frac{M^2}{r_h^2 F_r^2}$ , where  $FEF$  is the Fraction of Effective Force,  $M$  the propulsion moment,  $r_h$  the handrim radius, and  $F_r$  the resultant force applied to the handrim.

**Net joint moment:** minimum moment required at a joint to obtain the observed kinematics.

**Mechanical power:** product of handrim tangential forces and the manual wheelchair's speed

**Mechanical work:** time-integral of mechanical power