**Supplementary File 1 List of parameters used in the model.**

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| **Symbol** | **Definition** | **Value** |
| *r*0,A | Equilibrium length of the actin segment | 1.4×10-7 [m] |
| *r*c,A | Diameter of the actin segment | 7.0×10-9 [m] |
| *θ*0,A | Equilibrium angle of F-actin | 0 [rad] |
| *κ*s,A | Extensional stiffness of F-actin | 1.69×10-2 [N/m] |
| *κ*b,A | Bending stiffness of F-actin | 2.64×10-19 [N∙m] |
| *r*0,ACP | Equilibrium length of the ACP segment | 2.35×10-8 [m] |
| *r*c,ACP | Diameter of the ACP segment | 1.0×10-8 [m] |
| *θ*0,ACP | Equilibrium angle of ACP | 0 [rad] |
| *κ*s,ACP | Extensional stiffness of the ACP | 2.0×10-3 [N/m] |
| *κ*b,ACP | Bending stiffness of ACP | 1.04×10-19 [N∙m] |
| *r*0,M1 | Equilibrium length of the motor backbone segment | 42-138 [nm] |
| *r*c,M | Diameter of the motor backbone segment | 1.0×10-8 [N/m] |
| *θ*0,M | Equilibrium angle of the motor backbone | 0 [rad] |
| *κ*s,M1 | Extensional stiffness of the motor backbone | 1.69×10-2 [N/m] |
| *κ*b,M | Bending stiffness of the motor backbone | 5.07×10-18 [N∙m] |
| *r*0,M2 | Equilibrium length 1 of the motor arm | 1.35×10-8 [m] |
| *r*0,M3 | Equilibrium length 2 of the motor arm | 0 [m] |
| *κ*s,M2 | Extensional stiffness 1 of a motor arm | 1.0×10-3 [N/m] |
| *κ*s,M3 | Extensional stiffness 2 of a motor arm | 1.0×10-3 [N/m] |
| *k*n,A | Nucleation rate constant in network simulations | 1.0×10-6 [μM-1s-1] |
| *k*p,A | Polymerization rate constant in network simulations | 6.0×104 [μM-1s-1] |
| *N*h | Number of myosin heads represented by a motor arm | 8 |
| *N*a | Number of arms in a single motor | 4-48 |
| *κ*r,A | Strength of the repulsive force | 1.69×10-3 [N/m] |
| *N*M | Number of motors in the system | 1-2,000 |
| Δt | Time step | 1.15×10-5 [s] |
| *μ* | Viscosity of medium | 8.6×10-1 [kg/m∙s] |
| *k*B*T* | Thermal energy | 4.142×10-21 [J] |