

Supplementary Table 1: Model parameters. Parameter values are similar to those used in our previous work where the entire parameter list can be found (1, 2). This table shows values important and/or tuned in this study.

Symbol	Definition	Value
C_A	Actin concentration	25 [μM]
% Motors	[Ratio of C_M to C_A] \times 100	1
% ACPs	[Ratio of C_{ACP} to C_A] \times 100	1
$k_{u,ACP}^0$	Zero-force unbinding rate coefficient of ACP	0.115 [s^{-1}](3)
$\lambda_{u,ACP}$	Compliance of a bond for ACP unbinding	1.04×10^{-10} [m](3)
$k_{a,p}$	Actin polymerization rate	0.3 [$\mu\text{M}^{-1} \text{s}^{-1}$]
$k_{a,d}$	Actin depolymerization rate	0.3 [s^{-1}]
$k_{a,n}$	Actin nucleation rate	$n * 0.001$ [$\mu\text{M}^{-1} \text{s}^{-1}$]
n	Actin turnover scaling factor	1, at foci 0.01, at edges
$k_{adh,unb}$	Zero-force unbinding rate of adhesions between actin and substrate	$n_{adh} * k_{u,ACP}^0$
$\lambda_{u,adh}$	Compliance of a bond for adhesions	$\lambda_{u,ACP}$
n_{adh}	Adhesion unbinding scaling factor	0.1, at foci 10, at edges

Note: The bonds linking actin filaments with actin filaments (ACPs) and actin filaments with the substrate (adhesions) are modeled as slip bonds via Bell's equation (4) with unbinding rates equal to:

$$k_u = k_u^0 \exp\left(\frac{\lambda_u |F|}{k_B T}\right)$$

where $|F|$ is the tension acting on the bond, k_B is the Boltzmann constant, and T is temperature.

1. M. P. M. Wonyeong Jung, Taeyoon Kim, F-actin cross-linking enhances the stability of force generation in disordered actomyosin networks. *Computational Particle Mechanics* 2, 317 (2015).

2. M. Mak, M. H. Zaman, R. D. Kamm, T. Kim, Interplay of active processes modulates tension and drives phase transition in self-renewing, motor-driven cytoskeletal networks. *Nature communications* **7**, 10323 (Jan 8, 2016).
3. J. M. Ferrer *et al.*, Measuring molecular rupture forces between single actin filaments and actin-binding proteins. *Proceedings of the National Academy of Sciences of the United States of America* **105**, 9221 (Jul 8, 2008).
4. G. I. Bell, Models for the specific adhesion of cells to cells. *Science* **200**, 618 (May 12, 1978).