Documentation for MFPT code (Matlab)

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1 Overview of functions

`solve_mfpt.m`: This function takes the scale factor `k` (scales with cell aspect ratio, values stored in `kValsCtrlAR1p06to2.mat`) and solves the corresponding boundary value problem for the mean first passage time (**symmetric** energy landscape). There are several possible outputs. The first is `Y1`, the solution to the BVP. The second is `Y2`, which is the mean first passage time function (i.e. `Y1` divided by the splitting probability). The third is `splitProbs`, which is the splitting probability. All of these outputs are vectors that represent the values of the respective functions evaluated at starting angles α (denoted by the vector `x = linspace(0,pi)`).

`solve_mfpt_new.m`: This function takes the scale factors `k` and `j` (scale with cell aspect ratio, values stored in `AsymmValsAR1p06to1p67.mat`) and solves the corresponding boundary value problem for the mean first passage time (**asymmetric** energy landscape). It has the same possible outputs as `solve_mfpt.m`.

`BVPplot.m`: This function plots the desired output from `solve_mfpt.m` or `solve_mfpt_new.m` for starting angles α from 0 to π.

`solve_SAB.m`: This function plots the analytical solution of the single absorbing boundary problem for an absorbing boundary at $b = \pi/2$. It plots it for all possible starting angles $\alpha \in (0, \pi/2)$.

1.1 Inputs & parameters

`k` (`solve_mfpt.m`): Scale factor, = `k_1*Wmax = 0.001*Wmax`

`k` (`solve_mfpt_new.m`): Scale factor, = `Wmax`

`j` (`solve_mfpt_new.m`): Scale factor, = `Wmin`

`Y`: Function (in vector form) to plot via `BVPplot`

For `solve_mfpt.m`, the built-in Matlab BVP solver loses accuracy with values of k greater than 26, and does not tolerate values greater than 36. For `solve_mfpt_new.m`, the tolerated inputs are values of k less than 26,000 (values of j do not affect the accuracy of the solver).

1.2 .mat files

`SplitProbctrl.mat`: Contains a 6×100 matrix whose rows are the splitting probabilities (evaluated from $\alpha = 0$ to $\alpha = \pi$) for the on-center, symmetric spindle (AR = 1.07, 1.133, 1.2, 1.27, 1.33, and 1.4).

`SplitProbasymm.mat`: Contains a 7×100 matrix whose rows are the splitting probabilities (evaluated from $\alpha = 0$ to $\alpha = \pi$) for the off-center, asymmetric spindle (AR = 1.07, 1.133, 1.2, 1.27, 1.33, 1.4, and 1.47).

`BVPctrl.mat`: Contains a 6×100 matrix whose rows are the mean first passage time functions (evaluated from $\alpha = 0$ to $\alpha = \pi$) for the on-center, symmetric spindle (AR = 1.07, 1.133, 1.2, 1.27, 1.33, and 1.4).

`BVPasymm.mat`: Contains a 7×100 matrix whose rows are the mean first passage time functions (evaluated from $\alpha = 0$ to $\alpha = \pi$) for the off-center, asymmetric spindle (AR = 1.07, 1.133, 1.2, 1.27, 1.33, 1.4, and 1.47).

`kValsCtrlAR1p06to2.mat`: Contains a 1×15 vector `kvec`, which contains the scale factors k for the on-center, symmetric spindle (AR = `[16:30]./15`).

`AsymmValsAR1p06to1p67.mat`: Contains two 1×10 vectors, `kvecAsymm` and `jvecAsymm`, that contain the scale factors k and j (respectively) for the off-center, asymmetric spindle (AR = `[16:25]./15`).