



Keller Optimal Pacing

The fastest way to spend a finite engine over a fixed distance.

Keller's two-equation runner, solved for the policy that minimises time: full force to a cruise, hold what the store can afford, arrive empty.

SPORT

Athletics

FAMILY

The athlete

LICENCE

£349

one-off, perpetual

RUNNING IN THE PLATFORM

<https://edgewortharena.com/arena/api/factors/athlete?distance=1500>

Inputs

NAME	TYPE	UNITS	WHERE IT COMES FROM
distance	float	m	
F, tau, sigma, E0 (optional)	floats	m/s ² , s, W/kg, J/kg	the literature, or fitted to your athlete's own races
sigma_scale (optional)	float	-	altitude, heat, shoes and drafting all enter here

Outputs

NAME	TYPE	UNITS	NOTES
time	float	s	
cruise speed	float	m/s	
velocity and energy profile	arrays	m/s, J/kg	

Method

1 Integrate $dv/dt = f - v/\tau$ and $dE/dt = \sigma - f v$ with f bounded by F and E bounded below by zero.

THIS IS THE SAMPLE

The method runs to 3 steps; one is shown. The assumptions, the limits, the module layout and the reference implementation come with the licence. Everything on the page below this -- what the model was measured at -- is the same in both versions, because that is the part you should not have to take on trust.



What it was measured at

Solved now, for 1500 m on the literature constants.

MEASURE	RESULT	READING
Optimal cruise	6.85 m/s	
Predicted time	3:39.5	
Policy	full force, cruise, empty at the line	bang-bang then a singular arc
Where the environment enters	the aerobic supply σ	altitude, heat, shoes and drafting all act there

Assumptions

What has to be true for the numbers to mean what they say.

- A single aerobic supply rate and a single anaerobic store, both constant through the race.

Limits

Where it is known to be wrong. Published because a model without stated limits is one nobody has pushed on.

- It is a model of an even, optimal effort. It does not model tactics, packs, or the last-lap kick that decides championship races.

LICENCE

Issued to Evaluation copy. One perpetual licence to use and modify this model inside your own organisation. Redistribution of the specification or the reference implementation is not included. No warranty is given: the validation above is the whole of the claim being made.