Short Guide to the Tau-based Vehicle Guidance System Patent

Patent No.: US 8,065,044 B2 Vehicle Guidance System

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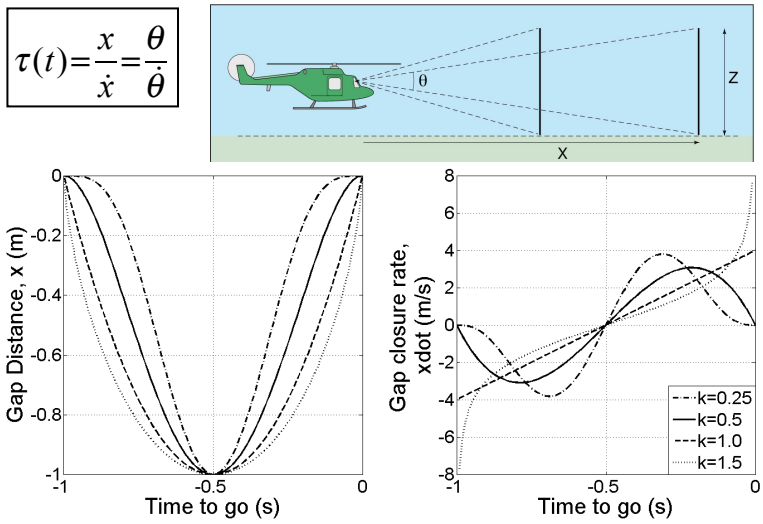
Patent Abstract: A vehicle guidance system comprising a measurement system and a processor arranged to receive information from the measurement system. The processor converts the information into one or more time-to-contact based parameters, which the control system uses either to automatically guide the vehicle or to provide vehicle guidance information to a pilot/operator.

Our research[1,2] has shown that when human beings and other animals make purposeful movements to close a gap, they are actually following mental patterns based on the time to close (tau) the spatial gap. Athletes, musicians, pilots, birds and insects all do this to perform and survive. An increased ability to follow these mental patterns, or *tau guides* as we call them comes with practice.

The time to close the gap, or time to contact as the patent describes it, is the essential variable of purposeful motion control. The helicopter pilot in the figure picks up the tau of the motion gap, x (where $\tau_x(t) = x/\dot{x}$), to the end hover position, from $\theta/\dot{\theta}$, the tau of the optical loom of the end position. The tau guides correspond to motion with constant acceleration or deceleration. Both of these primitive motions pertain to life that has evolved in the Earth's gravitational field. Simply keeping the tau of a motion-gap proportionally coupled to a tau guide allows the controlled closure of that motion gap with varying acceleration-then-deceleration or varying deceleration motion profiles, as shown in the figure above. In either case, the constant of proportionality (k) determines whether the motion gap closes gently or forcefully.

$$\tau(t) = \frac{x}{\dot{x}} = \frac{\theta}{\dot{\theta}}$$



The Basic Advantages of Tau Variables are: (i) tau variables, unlike other variables, can be directly sensed optically, acoustically, thermally, or by any other known sensory means; (ii) they do not require scaling or 'interpreting' in any way; (iii) they can form the key informational elements of guided motion; (iv) they can be fed either directly into a control system for automatic or augmented vehicle motion, or indirectly through a display for a pilot or operator to follow in manned operations e.g. flight in degraded visibility and crucially (v) they provide a means of compensating for the effects of undesired dynamic responses of the natural modes of motion of the guided vehicle/body.

The Application Areas of the Patent: The patent was written with flight vehicles in mind, manned or unmanned, but has wider application, e.g. road vehicles or any robotic device performing purposeful actions under motion control.

Would like more information? You can contact any of the inventors through their email addresses above and they will be happy to discuss all aspects of the invention. We have also written many papers on our research; 2 general papers are cited in the footnote, and they refer to other papers where more evidence of the compelling nature of tau in control is presented.

[1] Padfield, G.D., The Tau of Flight Control, The Aeronautical Journal of the RAeS, Vol. 115, No. 1171, September 2011.

[2] Lee, D.N., Guiding Movement by Coupling Taus, Ecological Psychology, 10, 221-250, 1998