Preface: One hundred years ago, scientists encountered a strange problem in the behavior of radiation, which was dubbed the "*ultraviolet catastrophe.*" It took nearly thirty years to settle the issue with modern "q*uantum mechanics*." In the 1980's, I projected that incredible speeds could be produced with my Natural Motion mechanism. It took a lengthy effort to recognize that I was dealing with a situation similar to the ultraviolet catastrophe of one hundred years ago, which I call, "*The Mechanical Ultraviolet catastrophe*."

The Mechanical Ultraviolet Catastrophe

Problems with Force, Energy and Momentum

by
Ali F. AbuTaha
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Wave-induced-motion, produced by the superposition and modulation of waves trapped in the bulk, reveals peculiar effects unnoticed before. Energy seems not to be conserved, momentum is not conserved, and two distinct forces, accelerating and non-accelerating forces, are detected, measured and analyzed in wave-induced motions. Infinite speeds, which seem to be attainable from simple mathematical projections, are simply not attainable. This paper discusses the above problems.

The basic features of wave-induced motions and directions to build and test motion models are given Refs. 1 and 2. During the evolution of the motion mechanism, I encountered problems relating to the concepts of force, energy and momentum, which I carefully tested, as described below.

A typical wave-induced motion model is given in Ref. 2 as follows:

Eccentric rotating mass, m $\approx$ 2g

Total mass of motion model, M $\approx$ 200g

Eccentricity or A $\approx$ 0.01m, and

$\omega_{av} \approx 100$ rad/sec.

When the two eccentric masses are rotated at 100 rad/sec ($\approx$ 16 cps), the model moves at about 10 cm/s. Here, the motion model contains two energy terms, (1) the kinetic energy of rotation of the elements and (2) the kinetic energy of linear motion of the model itself. It seems that the kinetic energy of rotation, $\frac{1}{2} I\omega^2$ for each element, is somehow related to the observed linear motions. If all the kinetic energy of the two rotating elements were turned into linear energy, then the model would move at about 14 cm/s, which compares well with the measured speed. The energy of rotation for the two elements is $E = m A^2 \omega^2$, or 0.002 Joule. For the measured 10 cm/s speed (s), the kinetic energy of motion is $E = \frac{1}{2} Ms^2$, or 0.001 J.

Again, when the model moves, it contains both the rotation energy of the inertia elements and the observed linear motion energy of the model. In other words, the total mechanical energy of the moving system is 0.003 J. From a purely mechanical viewpoint, the conservation of energy appears to be violated. It should be noted that when the two inertia elements are balanced, then rotation of the elements produces no motion, and the total mechanical energy of the system is only 0.002 J.

The problem is resolved by recognizing that the situation involves the energy derived from the power source, e.g., a battery. This is analogous to the energy derived internally in the body from food and turned externally into motion. This is to say that the linear motion is derived from the excess energy expended by the battery when driving unbalanced rotors, than when driving balanced rotors.

The motion models move faster when the rotation (or pulse) frequency is increased[1,2]. This behavior was tested with models ranging from a few hundred grams to more than 10 kg. The speed, s, can be estimated from energy consideration, for example, Eq. 9 in Ref. 2, or, $s = CNA\omega$, where, C is an energy conversion factor and N is $[2(m/M)]^{1/2}$. The following Table gives the calculated speeds for different pulse frequencies:

Table-1 Calculated speeds for different pulse frequencies

Frequency (Hz)	Speed (cm/sec) C=1	Speed (cm/sec) C=0.5
16	14.1	7
20	17.8	9
25	22.2	11
30	26.7	13
35	31.1	15

The above results are in general agreement with measurements. Similar behavior is shown in Videotape that was submitted by the author to several professional organizations.

During the development of the motion mechanism, it seemed natural to project the above behavior into higher frequency domains. The small 2-g eccentric elements can be rotated at 12,000 rpm with standard dc motors to produce a speed of about 6 km/hr. The following Table gives the projected speeds for very high frequencies:

Table-2 Projected speeds for high frequency domains

Frequency (Hz)	Speed (km/hr) C=1
200	6
10,000	320
100,000	3,200

The optimistic projections are shown schematically in Fig. 1. I tried in vain for years to achieve the above projections. But long before the rotation reaches 12,000 rpm (200 Hz), the model stops moving. All models, 0.2 to 20 kg, exhibit the increased-frequency increased-speed behavior in only a narrow frequency band, as shown in the Figure. No matter what parameters are changed, the incredible speeds cannot be attained. Figure 1, derived from my experiments with wave-induced motion models, is similar to the blackbody radiation curves that ushered the "*ultraviolet catastrophe*" and Quantum Mechanics one hundred years ago.

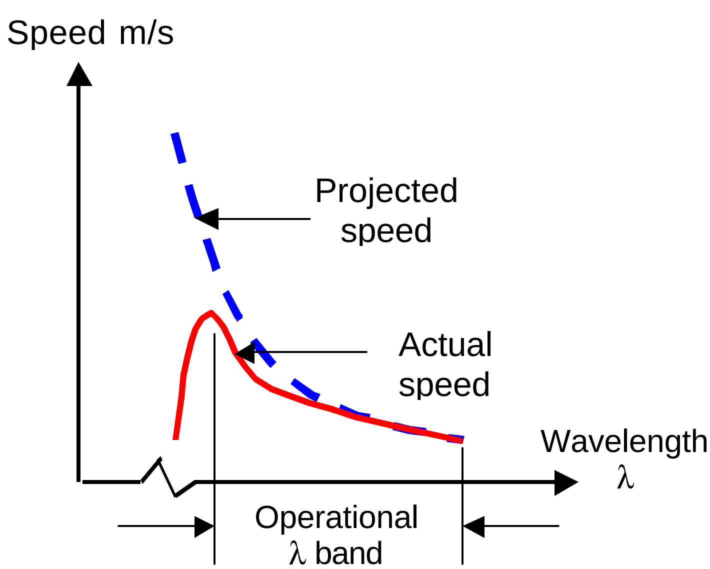

Fig. 1 Wave-induced motion identical to ultraviolet catastrophe

The curves in Fig. 1 indicate that the wave-induced motion is governed by quantum rules. Waves generated by the small dc motors produce linear motion of the physical motion model. Here, there is no confusion about what is wave and what is matter. The likely cause of motion is the superposition of traveling waves within the motion model[2]. It seems that the energy in two waves couple to produce a third energy packet. The modulated energy packet imparts an inertial force, or impulse, which causes the model to move. This is analogous to a system, such as a person on a chair with wheels, which can be set in motion by repeated impulses produced by the body. The modulation of the pulses in the muscles is organized to throw the body suddenly on the chair. When the act is repeated rhythmically, the system (person and chair) can move at seemingly constant speed, accentuated by the frequency of impulses (Fig. 4, Ref. 1).

The forces acting in wave-induced motions pointed to serious problems in the prevailing understanding of the nature of *force*. A free-body diagram of the typical motion model is shown in Fig. 2. In order for the model to move in the indicated direction, a force must be involved, which I call F_m. A friction force, F_s, must resist the motion. All motion models exhibit a *cutoff frequency*[1] f_o below which motion does not occur. Tests show that the cutoff frequency is related to the friction force. As with energy, the driving force is estimated from the inertia force of the rotating elements. For the elements rotating at 100 rad/s, $F_m = m A \omega^2$, or 0.4 N. The static coefficient of friction, m_s, was measured at about 0.18, which gives a friction force, $F_s = m_s W$, of approximately 0.35 N, which was confirmed with force measurement.

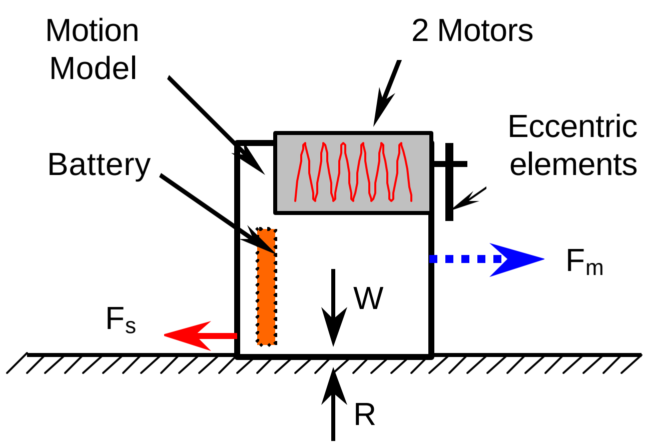

Fig. 2 A free-body diagram of a typical motion model

The relationship that $F_m > F_s$ is required to produce wave-induced motion explains the cutoff frequency behavior. This was tested for many models. For example, the inertia forces required to initiate the motion of 1, 5 and 10 kg models are approximately equal to the friction forces of 3, 15, and 30 N, where m_s, ≈ 0.3.

It has been the practice to use Galileo's and Newton's law of inertia to eliminate the two vectors F_m and F_s from free-body diagrams, such as in Fig. 2, and to say that the model moves with a zero *net force* acting on it. The law of inertia, however, is strictly meant for frictionless motions. This matter requires resolution by the physics and other professional communities.

The motion models exhibit the presence of a driving force. The models can push or pull weights equal to their own weights. The models move up inclined surfaces and pull weights up the inclined surfaces. At higher frequency, a motion model extends a spring scale farther than at low frequency. At higher frequency, the models push greater weights. At higher frequency, there appears to be a greater "motive force."

As in the cases of energy and speed above, the "motive forces" have been estimated for the typical motion model from the rotational inertial forces. The results are given in Table-3.

Table-3 Calculated forces for different pulse frequencies

Frequency (Hz)	Speed (cm/sec) C=0.5	Force, F_m (N)
16	7	0.4
20	9	0.6
25	11	1.0
30	13	1.4
35	15	1.9

When the frequency is increased from f_o to f_4, or 16 to 35 Hz, the model accelerates from about 7 to 15 cm/s, see Fig. 3. At f_4, the force calculations indicate that a force of 1.9N is acting to move the model. The friction force is still less than 0.4 N. There is a force difference of about 1.5N (or, 1.9 – 0.4). Using Newton's F=ma, the model should accelerate at about 7.5 m/s^2. But, at f_4, the model does not accelerate at all; the model moves at the constant speed s_4. The model also moves at constant speeds at f_1, f_2, f_3, and at every other frequency between f_o and f_4. Careful study of Fig. 3 reveals a latent problem; namely, the presence of two forces. There is the acceleration force, which is evident from the acceleration slope, and there is the motive force associated with each operational frequency. The latter force produces only constant speed, with no acceleration, even though it manifests other properties of forces. This matter also requires resolution by the physics and other professional communities.

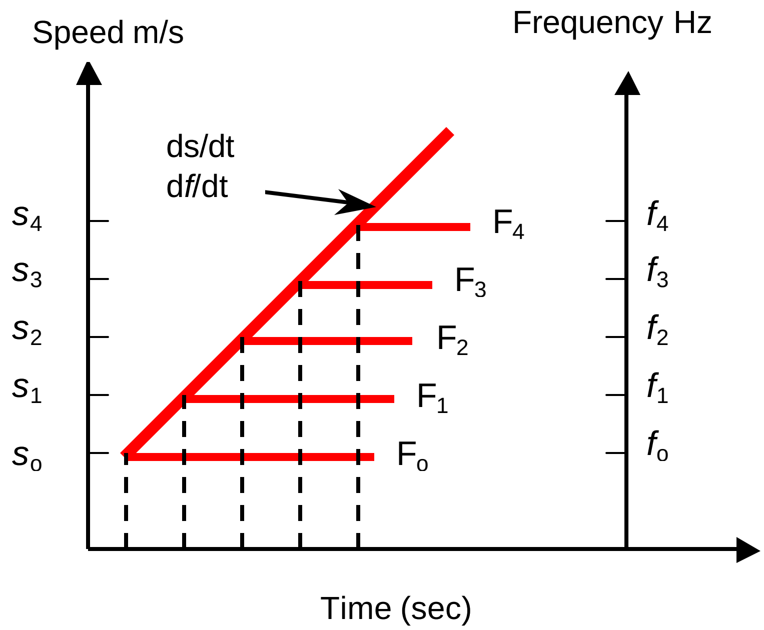

Fig. 3 Accelerating (Newtonian) and non-accelerating (Aristotelian) forces

Fig. 3 and Table-3 clarify some of the great debates about the nature of motion and force that raged over the centuries. Sir Isaac Newton clearly saw the slope in Figure 3 and derived the valuable mathematical relationship, F=ma, of force and acceleration. Aristotle's constant force for constant speed was discarded as unimportant and useless. The experimental behavior of wave-induced motion shown in Fig. 3 demonstrates the value of both opinions.

Another peculiar behavior in wave-induced motions relates to the conservation of momentum. Each disturbance propagating within the motion models should reflect and set up equal but opposite reaction within the body. The sum of the disturbances within a motion model, according to the action-reaction law, must be zero, and no motion whatever should result from the wave disturbances traveling within the body. That this law of momentum conservation is violated in wave-induced motions is self-evident.

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[1]AF AbuTaha, "Discovery of Self-Motion," 1999.

[2]AF AbuTaha, "Wave-Induced Motions," 1999.