Viewpoint Matters

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Observational Perspectives

Observation and measurement of a natural event may result in data which is summarized and normalized to a physical constant. It may be beneficial to generalize or disassociate the data summary from any normalization constant. This generalization may be achieved by the use of observational perspectives . These perspectives may be included in a definition of the uncertainties associated with the observation.

Two perspectives (,) shall be identified;

− a delta perspective associated with a delta time operator (/ t)

− a differential perspective associated with a differential time operator (/ t)

It is simplifying (and possibly misleading) to call the differential operator a subjective perspective and also to name the delta operator as an objective perspective .

It is also possible to associate the differential perspective with momentum (p) and assume the delta operator acts upon position (x). These assumptions are arbitrary (also convenient) and are not required by nature.

The perspectives may be illustrated by a hypothetical observation of the motion of an airplane. A passenger inside the airplane will experience a force (F) acting upon him due to a change in the momentum of the aircraft (and of the passenger). This will be identified as the subjective perspective (differential perspective).

F = p / t

A person observing the same airplane from the ground will be unaware of the forces acting upon the passenger. He will notice a spatial displacement of the airplane with respect to time . He may infer a velocity (v) and this will be assumed to be the objective perspective (delta perspective).

v = x / t

The uncertainties of momentum (p) and position (x) are associated with the two perspectives of observation (,) and combined as an increment of angular momentum (U) called the uncertainty product .

 x p = U = P t t (E1)

Where power (P) is; P = Fv

Heisenberg s Principle of Uncertainty with respect to position and momentum may be represented as;

 x p = nh (E2)

Where;
 h is Plank s constant, which is a fundamental unit of angular momentum.
 n represents a ratio dependant upon the event being observed
 x represents an uncertainty of position
 p represents an uncertainty of momentum

Please note the similarities and the differences between the two equations E1 and E2. Both represent the product of uncertainties as some type of angular momentum (U,nh). Heisenberg s uncertainties are both delta uncertainties and do not include a differential uncertainty. For photo−electro−magnetic events the Heisenberg relationship is appropriate, however there may be other observations that require a generalization as represented by E1.

Observational Reference System;
It is necessary to define some type of observational reference system to serve as a benchmark for experimental observations. The system shall be a set of ratios which relate observed characteristics to benchmark (or infered) characteristics. The benchmark characteristics shall be identified as follows.

Benchmark force (Fb) and momentum (pb) are related by the differential time operator;

Fb = pb / t

An experimental observation of force (F) may be referenced to the benchmark force as a force ratio (RF).

RF = F/Fb

Benchmark velocity (vb) and position (xb) are related by the delta time operator;

vb = xb / t

An experimental observation of velocity (v) may be referenced to benchmark velocity as a velocity ratio (RV).

RV = v/vb

The benchmark uncertainty product (Ub) is; Ub = xb pb

An experimental uncertainty product (U) may be referenced to the benchmark uncertainty product as an uncertainty ratio (RU)..

RU = U/ Ub = RVRF = Tan(q)

Where the angle (q) is called the event angle .

The power (P) associated with an observed event is; P = Fv

A benchmark power (Pb) is; Pb = Fbvb

The power ratio (RP) is; RP = P/ Pb = RVRF = RU (E3)

The ratio of uncertainty is equal to the power ratio; RU = RP

This does not imply that the uncertainty product is a magnitude of power.

The ratios of force and power are assumed to combine as follows; RF2 − RP2 = 1 (E4)

This does not imply that power is a vector magnitude. Power is scalar magnitude.

An unobservable ratio is represented by the complex multiplier (i).
The power ratio is unobservable;
iRP = (1 − RF2)½

Substitution for RP (from E3) in E4 gives; RF−2 + RV2 = 1 (E5)

The ratios in E5 are ratios of vector magnitudes.

Mass Ratio;
A mass ratio (Rm) is; Rm = m/mb

It may be determined if the following assumptions are true.

Benchmark momentum; pb = mbv (this assumption is not necessarily true)

Event momentum; p = mv

Giving; Fb = pb / t = mb v/ t

F = p/ t = m v/ t

RF = F/Fb = m/mb = Rm (E6)

From equation 5; RF−2 + RV2 = 1

Substitution for RF (from E6) in E5 gives;

Rm−2 + RV2 = 1

(mb/m)2 + (v/vb)2 = 1

Relativistic mass is obtained if; mb = m0 (rest mass)

vb = c (speed of light in vacuum)

Giving; (m0/m)2 + (v/c)2 = 1

Motion;
A moving object may have two possible types of motion, discontinuous motion or continuous (cyclical) motion. An object in cyclical motion may have a circular or an elliptical trajectory. An object in discontinuous motion, such as a ball thrown into the air will follow a segment of a parabolic trajectory and will have a beginning limit and an ending limit. If both perspective ratios are known, the trajectory of an observed object and its uncertainty product may be obtained.

Discontinuous Motion;
If the discontinuous motion of an object is assumed to limit it s center to a spatial plane, then the definition of the trajectory will be simplified. This is plane restricted motion . The definition of a trajectory ratio (RT) is a ratio of perspective ratios.

RT = RF/RV

A parabolic trajectory is; RT = ½

RF = ½ RV

It shall be assumed that observed momentum is; p = mwx

Where; m is the dynamic mass of an observed object

w is frequency

x is location

Observed force (F) is; F = p/ t = mwx/ t = mw x/ t

Benchmark force (Fb) is; Fb = mw xb/ t

The force ratio is; RF = F/Fb = x/ xb

Observed velocity (v) is; v = x/ t

Benchmark velocity (vb) is; vb = xb/ t

The velocity ratio is; RV = v/vb = x/ xb

A parabolic trajectory is; RF = ½ RV

x/ xb = ½ x/ xb

xb/ x = ½ xb/ x

Let; x = x − x0

xb = xb − xb0

Giving a differential equation; (xb − xb0) / (x − x0) = ½ xb/ x
(E7)

The solution of E7 is; (xb − xb0) = −k(x − x0)2

Where; ½ xb/ x = −k(x − x0)

This is a parabolic trajectory with plane co−ordinates (x, xb) and maxima (x0 ,xb0).

The start limit is; (0, xb0 − kx02)

The end limit is; (x0 + [xb0/k]½ , 0)

The product of uncertainty is; U = mw(x − x0) x = p x

In this example; p x = x p

Continuous motion can also be represented by perspective ratios.

Conclusion;

Observational perspectives (,) are associated with time operators and they generalize observational uncertainties.

Uncertainties may commute with respect to perspective.

Observed characteristics (F,v) are vector magnitudes derived from time operators acting upon fundamental characteristics (p,x).

An observational reference system is a set of ratios (RF ,RV) which relate observed characteristics (F,v) to inferred characteristics (Fb,vb).

Unobservable characteristics are complex (i).

If a reference system includes perspectives then a trajectory ratio (RT) and an uncertainty product (U) can be defined.

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