Designing the attractors and deflectors in the trajectory

It is anticipated that game designers would have more freedom to create fun games if there was freedom to place attractors (gravity wells) or deflectors:

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The attractors/deflectors should alter the positionally linear trajectory. One way to achieve this mathematically is to apply a virtual admittance filter.

The first step is to generate a virtual force on the end effector. This is best done as separate x and y components, since the unaffected trajectory is also generated as separate x and y components. A modified version of Hooke’s Law may be implemented for the attractor, whereby the force increases the closer the end effector gets to the attractor:

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| --- | --- |
|  |  |

Where in this case x represents the component distance between from the end effector to the attractor:

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|  |
| Positive dx, dy |

Positive dx, dy.

|  |
| --- |
|  |
| Positive dx, Negative dy |

The admittance filter is shown by the following equation:

|  |  |
| --- | --- |
|  | *(3.26)* |

Substitute the equation before and we get the simplified:

|  |  |
| --- | --- |
|  | *(3.26)* |

We can evaluate the limits, to find out the maximum and minimum displacements:

|  |  |
| --- | --- |
|  | *(3.26)* |
|  | *(3.26)* |
|  | *(3.26)* |

Thus maximum displacement is infinite:

|  |  |
| --- | --- |
|  | *(3.26)* |

Thus minimum displacement is zero:

|  |  |
| --- | --- |
|  | *(3.26)* |

This doesn’t tell the full story however, because if we analyse the graph we can see that there is no noticeable displacement until we get closer than 1mm, and the effects before this are negligible:

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We must design a better exponential curve. The ‘Knee’ of the curve, for lack of a better term, and start affecting place may be adjusted with the addition of 2 coefficients (and getting rid of t):

|  |  |
| --- | --- |
|  | *(3.26)* |

With the following effects:

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| Every coefficient at 1 |
|  |
| A=100 |
|  |
| A =100, r=1.5 |
|  |
| A=100,k=10 |
|  |
| A=100,c=10 |

Play on Desmos to find out. <https://www.desmos.com/calculator>