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Joint Research of Optics and Fluid Interface

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Subject Index xxxx, xxx

1 Setup

Let Δ be the total width the light travels with path not being straight, hence:

$$\forall x \notin [-\frac{\Delta}{2}, \frac{\Delta}{2}] : \frac{d^2}{dx^2} y = 0 \tag{1}$$

Now define the light ray incoming from left-hand side towards right-hand side and (suppose transition layers' width approaches zero) refracs at origin. And let h be the thickness of the transition layers.

Now let's assume the incoming transition layer has the same thickness as outbounding transition layer, hence we get:

$$\Delta = \frac{h}{2}(\tan\theta_{in} + \tan\theta_{out}) \tag{2}$$

Now we can first confirm our path function is a function of $\theta_{in}, \theta_{out}, h$

$$P(\theta_{in}, \theta_{out}, h) = \tag{3}$$

2 Playing with Bezier Curve

First setup the environment

```
h, t=var("h t")
hh=h/2
theta, phi=var("theta phi")
assume(h, "constant")
assume(h>0)
assume(0<theta, theta<pi/2)
assume(0<phi, phi<pi/2)
```

And now we could try to solve functions like $y(x)$ from parametric bezier curve:

```
# x(t)=(t-1)^2*tan(theta)*hh*-1+t^2*tan(phi)*hh
y=(t-1)^2*hh-t^2*hh
```

First we try to find $t(x)$

```
result=[]
[((abs(res.rhs()(x=tan(theta)*hh*-1)(h=2, theta=0.2, phi=0.4))<1e-12 and
 abs(res.rhs()(x=tan(phi)*hh)(h=2, theta=0.2, phi=0.4)-1)<1e-12) and
 result.append(res))
```

```
 for res in solve((t-1)^2*tan(theta)*hh*-1+t^2*tan(phi)*hh==x, t)]
t=result[0].rhs() if len(result)==1 else None
```

Where we get two solutions and only one will satisfied our assumptions (the first print is 0 and the second yields 1[1]), which is:

$$-\frac{h\tan(\theta) - \sqrt{h^2\tan(\phi)\tan(\theta) + 2\,(h\tan(\phi) - h\tan(\theta))x}}{h\tan(\phi) - h\tan(\theta)}$$

And substituting back to $y(t)$ we could get

3 Analyzing

Given a full path from v_1 to v_n, whose path will be $y(v_1, v_n, h)(x)$, we could seperate it into different sections.

$$\underset{i\to i+1}{\Delta} = \frac{h}{n-1}\frac{1}{2}(\tan\theta_i + \tan\theta_{i+1}) \tag{4}$$

$$\sum_{i=1}^{n-1}\underset{i\to i+1}{\Delta} = \frac{h}{2}(\tan\theta_1 + \tan\theta_n)$$

$$\forall x \in \underset{i\to i+1}{\Delta}: \tag{5}$$

$(x, y(v_1, v_2, h_{12})(x)) + (\underset{2\to n}{\Delta}, \underset{2\to n}{h})$

[1] Here we use $EPS = 1e-12$ as we're testing it with arbitrarily chosen values which makes them no longer symbolic.

4 Finding path

4.1 Constructing Layers

Let function $v(\theta_{in}, \theta_{out}, \Delta, \delta)$ be the velocity of layer δ (from the entry interface), whose entry velocity is θ_{in}, exit velocity is be θ_{out}, and the whole layer thickness is Δ.[2]

$$a = v(x, y, \beta - \alpha, \alpha) \tag{6a}$$

$$b = v(x, y, \beta - \alpha, \beta) \tag{6b}$$

$$\alpha \leq \beta \tag{6c}$$

Let $a = v(x, y, \alpha)$ and $b = v(x, y, \beta)$ $(\alpha \leq \beta)$, $\forall p \in [\alpha, \beta] : v(a, b, p - \alpha) = v(x, y, p)$

4.2 Fractal Structure

$$\text{Let } P(\theta_{in}, \theta_{out}, h) \text{ be the path taken} \tag{7}$$

$$P(\theta_{in \to \alpha}, \alpha) = P(\theta_{in}, \theta_{\alpha} \tag{8}$$

[2] Here we suppose every layer paraelles

5 Regarding Special Relativity

So first let the real velocity v, whom maintains the linear properties of traditional non-relativistic velocity.

Linear to non-linear (relativistic) velocity:

$$v_S = \frac{v_{\text{リ}} \text{エ}_S \text{リ}}{\text{エ}_S S} = v_{\text{リ}} \text{エ}_S \text{リ} \tag{9}$$

5.1 *Constant force/acceleration*

Let a point located at origin, with initial velocity $v(0) = 0$.

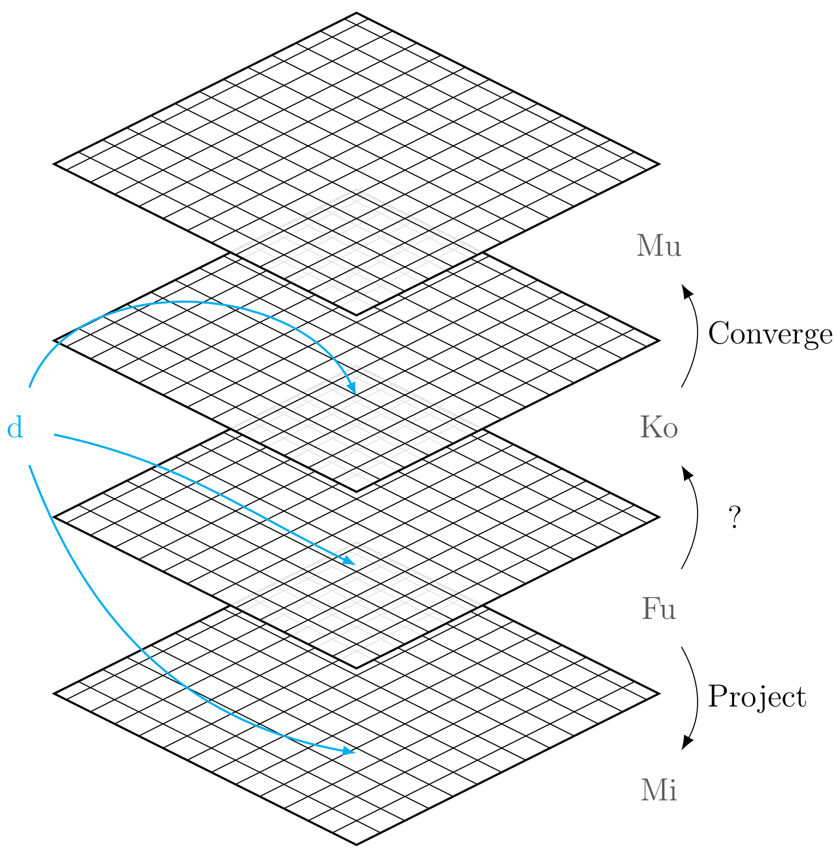
$$a_{\text{ヒ}}(v, F, m_{rest}) = \frac{F}{m_{rest}} \sqrt{1 - \frac{v^2}{c^2}}^3 \tag{10a}$$

$$a_{\text{リ}}(t) = k \tag{10b}$$

$$v_{\text{ヒ}}(t) = v_{\text{リ}} \text{エ}_S \text{リ} = kt \text{エ}_S \text{リ} \tag{10c}$$

$$v_{\text{ヒ}}(t) = \int \frac{F}{m_{rest}} \sqrt{1 - \frac{v_{\text{ヒ}}(t)^2}{c^2}}^3 \tag{10d}$$

6 Model of Particles



7 Conclusion

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Acknowledgment

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References

[1] `https://www.mail-archive.com/dou-geometry@googlegroups.com/msg00004/____________-_____________ ______________.docx`

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