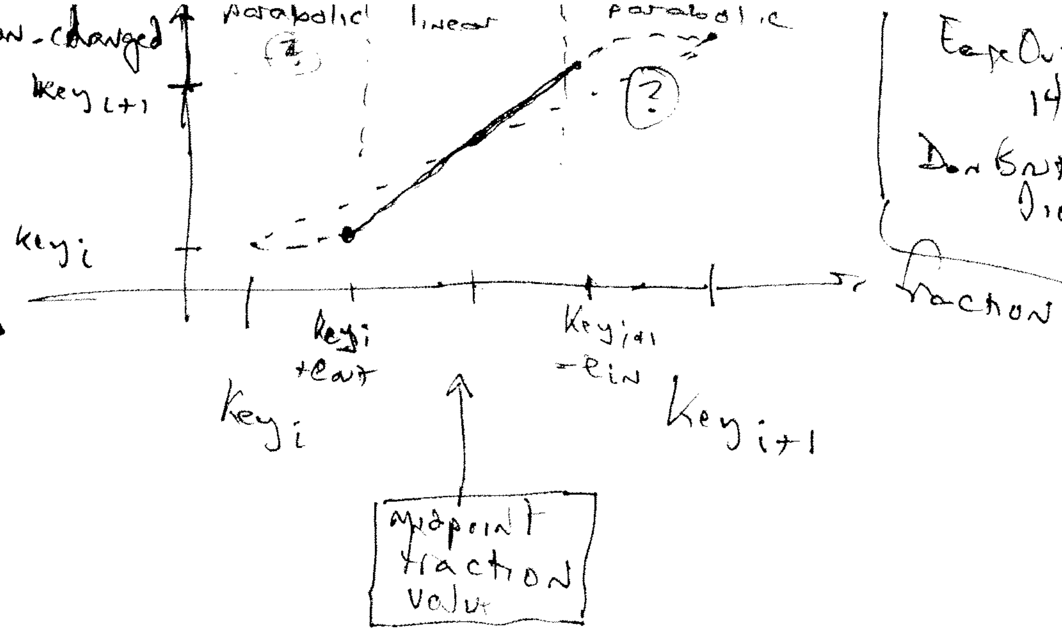
Derivation of 19.4.4 EaseIn EaseOut

EaseOut EaseIn
14 MAR 201

Don Brutzman,
Dick Puk



possible spec issues: problem for easeInEaseOut final value (?)
problem with definition of modifiedFraction_changed (?)

various typos corrected, inserted comma in paragraph a

Notes on algorithm (see 19.4.4 EaseInEaseOut

a. u = set_fraction field value. (-∞..∞)

b. e_{out} = easeInEaseOut[i].y

c. e_{in} = easeInEaseOut[i+1].x

d. S = sum. If sum < 0, ignore computation by using fraction

f. implications: ein + eout = 1

g. Note t = 1/2 if S > 1 and normalizn occurred, which is probably OK.. need to confirm

EdgeIn EdgeOut

(2)

g. $t = \frac{1}{(2 - e_{out} - e_{in})}$

h. $\frac{t}{e_{out}} \cdot u^2 = \frac{1}{(2 - e_{out} - e_{in})e_{out}} \cdot u^2$

i. $t(2u - e_{out}) = \frac{1}{2 - e_{out} - e_{in}}(2u - e_{out})$

j. $1 - \frac{((t \cdot (1-u)^2)}{e_{in}} = 1 - \frac{\frac{1}{(2 - e_{out} - e_{in})}(1-u)^2}{e_{in}}$

$= \frac{1}{e_{in}} - \frac{(1-u)^2}{(2 - e_{out} - e_{in})e_{in}}$

Are eqns (h) & (i) contiguous at e_{out}?

NO

Are eqns (i) & (j) contiguous at e_{in}?

NO

does quantity (h) equal quantity (j) at $u = e_{out}$?

$$\text{quantity (h)} = \frac{u^2}{(2-e_{out}-e_{in})\,e_{out}} \overset{?}{=} \frac{1}{e_{in}} - \frac{(1-u)^2}{(2-e_{out}-e_{in})\,e_{in}} = \text{quantity (j)}$$

$$\frac{e_{out}^2}{(2-e_{out}-e_{in})\,e_{out}} \overset{?}{=} \frac{1}{e_{in}} - \frac{(1-e_{out})^2}{(2-e_{out}-e_{in})\,e_{in}}$$

$$\overset{?}{=} \frac{(2-e_{out}-e_{in}) - (1-2e_{out}+e_{out}^2)}{(2-e_{out}-e_{in})\,e_{in}}$$

$$\overset{?}{=} \frac{1+e_{out}-e_{in}+e_{out}^2}{(2-e_{out}-e_{in})\,e_{in}}$$

multiply both sides by $(2-e_{out}-e_{in})$

$$\frac{e_{out}^2}{e_{out}} = e_{out} \overset{?}{=} \frac{1+e_{out}-e_{in}+e_{out}^2}{e_{in}}$$

NO

$\therefore$ equations (h) and (i) are not contiguous at fraction $= u = e_{out}$

does quantity (i) equal quantity (j) at $u = e_{IN}$?

$$\text{quantity (i)} = \frac{(2u - e_{out})}{2 - e_{out} - e_{IN}} \overset{?}{=} \frac{1}{e_{IN}} - \frac{(1-u)^2}{(2 - e_{out} - e_{IN}) \cdot e_{IN}} = \text{quantity (j)}$$

substituting

$$\frac{(2 \cdot e_{IN} - e_{out})}{2 - e_{out} - e_{IN}} \overset{?}{=} \frac{1}{e_{IN}} - \frac{(1 - e_{IN})^2}{(2 - e_{out} - e_{IN}) \cdot e_{IN}}$$

$$\frac{2 \cdot e_{IN} - e_{out}}{2 - e_{out} - e_{IN}} \overset{?}{=} \frac{(2 - e_{out} - e_{IN}) - (1 - 2e_{IN} + e_{IN}^2)}{(2 - e_{out} - e_{IN})\, e_{IN}}$$

Multiply both sides by e_{IN}

$$e_{IN} \cdot \left[\quad " \quad \overset{?}{=} \frac{1 - e_{out} + e_{IN} + e_{IN}^2}{(2 - e_{out} - e_{IN})\, e_{IN}} \right]$$

$$\frac{2e_{IN}^2 - e_{IN}\, e_{out}}{(2 - e_{out} - e_{IN})} \overset{?}{=} \frac{1 - e_{out} + e_{IN} + e_{IN}^2}{(2 - e_{out} - e_{IN})}$$

NO

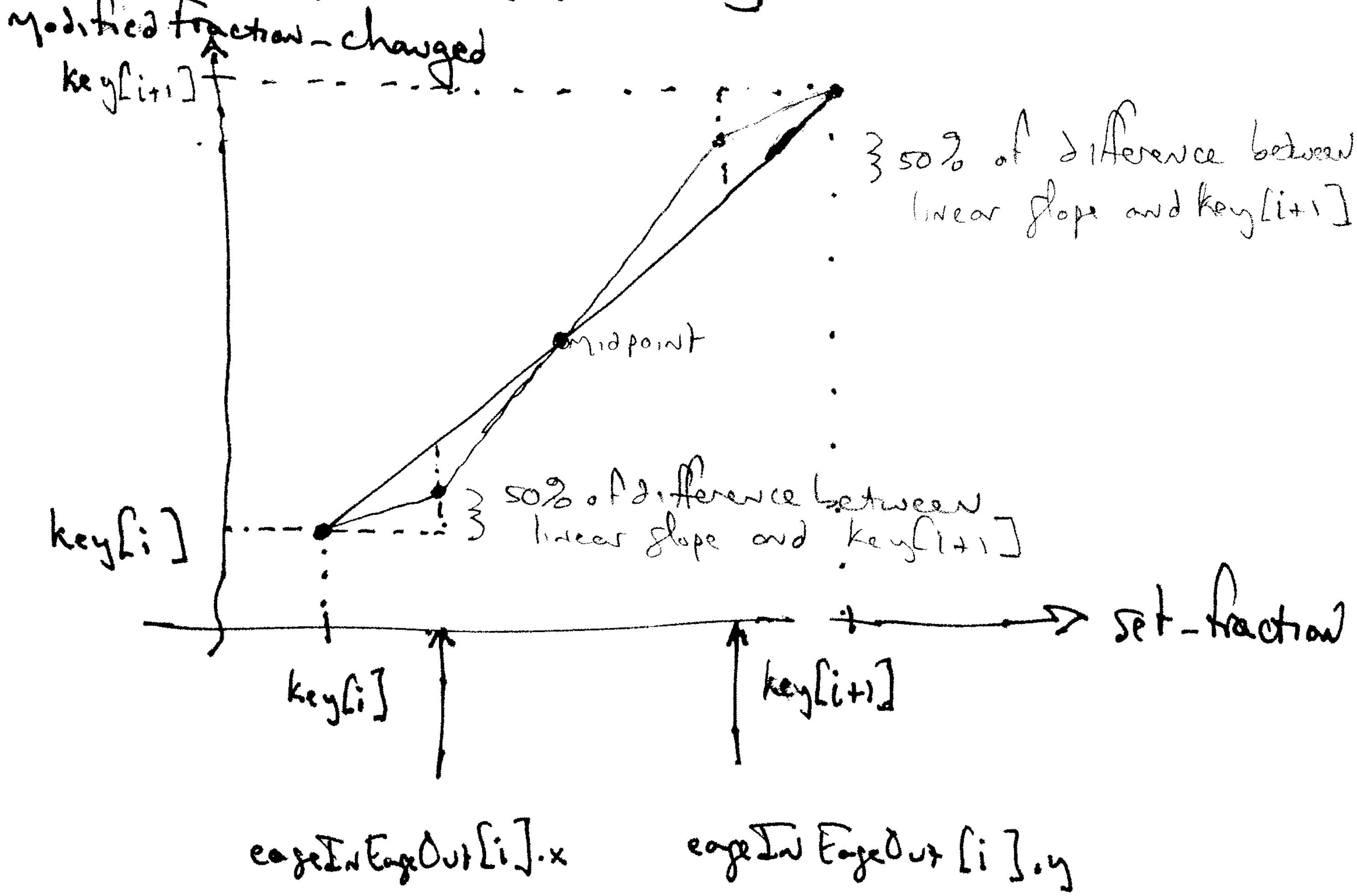
∴ equations (i) and (j) are <u>not</u> contiguous at fraction $= u = e_{IN}$

All this seems much more complicated (not to mention incorrect!) compared to original linear algorithm.

Suggested improvement: linear model

easeInEaseOut[i].x is key fraction for half-value range out

easeInEaseOut[i].y is key fraction for half-value range in



- If only one easeInEaseOut value is provided, it is repeated for each key[i], key[i+1] pair

- Suggested default:

  MFVec2f [in, out] easeInEaseOut [0.1, 0.9] (-∞, ∞)

- If no easeInEaseOut is provided, the default value is used

- If the size of easeInEaseOut is > size of key array excess values are ignored

- If the size of easeInEaseOut array is < size of key array the default value is used for each missing value.

- This provides default values that are benign, helpful, and can be used without modification