Example: elastic version of volume kernel

$$r = \sum_{c=1}^{3} \left[A^{e}_{k,c} \cdot (T^{e}_{k}) \cdot K_c \right] \cdot M^{-1}$$

$\hookrightarrow \beta \times \beta$ inverse diagonal mass matrix

$A^{e}_{k,c}$: element-local linear combinations of elastic Jacobians, 9×9

T^{e}_{k}: Dofs, $9 \times \beta$

K_c: three stiffness matrices, $\beta \times \beta$ (x3), defined by tetrahedrons

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approach 1

Fp32 → upper: bf16 T_1 + lower: bf16 T_2

Fp32 → upper: bf16 K1 + lower: bf16 K2

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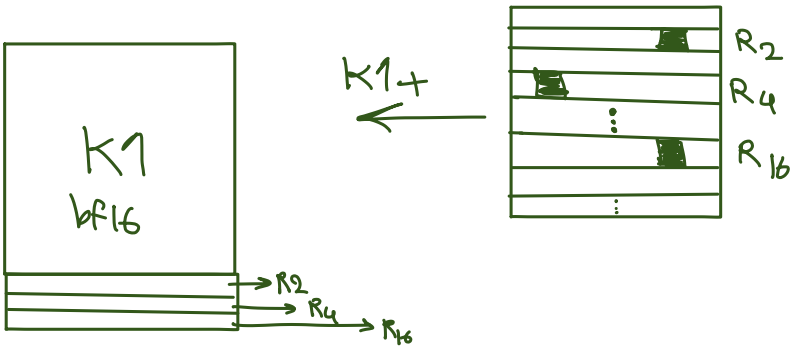
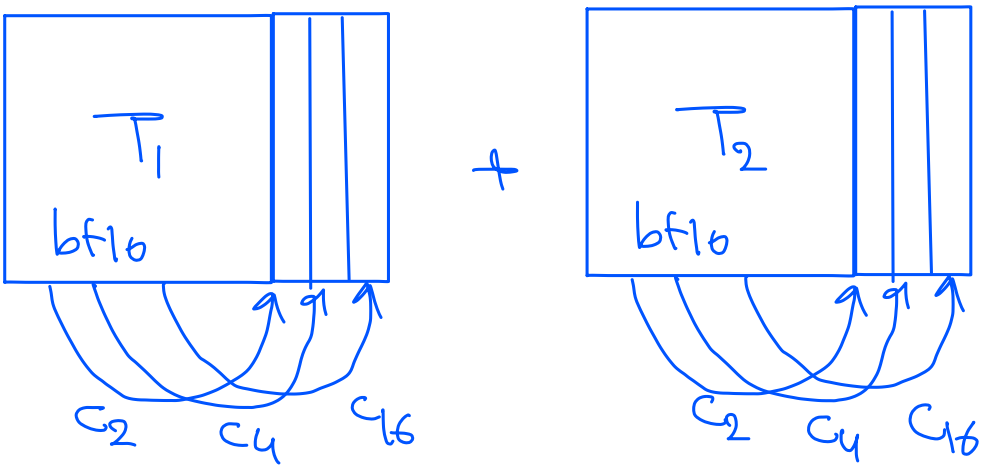
approach2



Fix matmul → T1 & T2 need new Cols



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m = 20

n = 9 ⇒ T x K → 3x20x9x35 x2 Flops → bf16

K = 35

A x T → 3x20x9x9x2 Fflops → fp32

80%

$$\begin{cases} A \in R^{9\times 9} \\ T \in R^{9\times 20} \\ K \in Q^{20\times 35} \end{cases} \times 3$$