

## Programming C++

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### Project **Kahan**

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#### **Kahan summation:**

Numerical computation by floating point numbers in the computer cause roundoff errors due to the limited precision available. Summing large and small numbers together might result in non neglectable final error.

The Kahan summation<sup>1</sup> is one approach to compensate this error.

1. Start with the skalar product code (tar<sup>2</sup>). and extend it with a new function `Kahan_skalar` that performs the summation therein according to Kahan.
2. Calculate the sum

$$s_n := \sum_{k=1}^n \frac{1}{k^2}$$

for increasing  $n$  and compare the difference of the results from the two functions.

- Use compiler option **-O1**, not option -O2 or higher for the `Kahan_skalar`.

3. We know that  $s_n \rightarrow \frac{\pi^2}{6}$  for  $n \rightarrow \infty$ .

Compare the two results with this value for  $n \rightarrow \infty$ .

Hints: `#include <cmath>`, `M_PI`

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<sup>1</sup>[https://en.wikipedia.org/wiki/Kahan\\_summation\\_algorithm](https://en.wikipedia.org/wiki/Kahan_summation_algorithm)

<sup>2</sup>[https://imsc.uni-graz.at/haasegu/Lectures/Math2CPP/Codes/seq/skalar\\_stl.tar](https://imsc.uni-graz.at/haasegu/Lectures/Math2CPP/Codes/seq/skalar_stl.tar)