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New Geometrical Filtratation For Ultra-Precision And Micro,Nano Manufactured Products

Original Citation


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The aim of this project is to explore and develop fast and stable algorithms, standard reference algorithms, and measurement procedures for non-linear geometrical Gaussian and spline filtration. Focusing on:

- Exploration of suitable numeric models for robustness and stability of non-linear filters.
- Creation of fast algorithms for the efficient implementation of non-linear Gaussian and spline filters.
- Development of standard reference algorithms implementing the definitions according to the ISO 16610 series of standards.

\[
\sum_{k=0}^{n-1} \rho \left( z_k - s(x_k) \right) + 2 \int_{s(x_0)}^{s(x_{n-1})} \left[ \frac{d^2 s(x)}{dx^2} \right]^2 dx \rightarrow \text{Min } s(x_k)
\]

<table>
<thead>
<tr>
<th>L2</th>
<th>L1</th>
<th>Huber</th>
<th>Cauchy</th>
<th>Tukey</th>
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<td>(n L2)</td>
<td>(n L1)</td>
<td>(n \text{ Huber})</td>
<td>(n \text{ Cauchy})</td>
<td>(n \text{ Tukey})</td>
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Generalised higher order gaussian regression filter for 2D Profile

Generalised higher order gaussian regression filter for 3D surface

Fast algorithms:
1. Convolution to FFT;
2. Pre-calculation;
3. Separable in rows and cols

Significant speed improvement:
For a typical 60,000 pts data, 100 ms is needed compared with traditional algorithms need a few hours