Parallel algorithm

Core ideas

- **Sequential**: single procedure sweeping all the vertices sequentially.
- **Parallel**: multiple procedures (local growths) running simultaneously.
  - A local growth is started at every minimum.
  - Each local growth explores the mesh with an ordered BFS.
  - Each local growth updates its own preimage graph G_r.
  - **Join saddles**: wait until all involved local growths have reached the saddle, then join them.
  - **Split saddles**: the new open edges in $\mathcal{R}(f)$ are handled by the same local growth.

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Local growths

Data structures

Each local growth keeps:

- a **Fibonacci heap** θ to store candidates for the ordered BFS.
- an **ST-tree** G_r to store the preimage graph.

can be merged in $O(1)$

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Procedure

```
1 procedure LocalGrowth(v_0, R, Φ)
2 |   θ, G_r ← {v_0} [Fibonacci heap], ∅ [ST-tree];
3 |   while θ is not empty do
4 |   |   v ← vertex in θ with minimal f value;
5 |   end
6 end
```