Dörfler marking with minimal cardinality is a linear complexity problem

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In his seminal work [1], Dörfler proposes a marking criterion, which allows to prove linear convergence of the usual adaptive finite element algorithm. Given refinement indicators $\eta(T)$ for all elements $T \in \mathcal{T}$ of a triangulation $\mathcal{T}$ and a marking parameter $0 < \theta \leq 1$, a set $\mathcal{M} \subseteq \mathcal{T}$ satisfies the *Dörfler marking* criterion, if

$$\theta \sum_{T \in \mathcal{T}} \eta(T)^2 \leq \sum_{T \in \mathcal{M}} \eta(T)^2 .$$

Later it was shown in [2] that the Dörfler marking criterion is not only sufficient to prove linear convergence, but even in some sense necessary. In the literature, different algorithms have been proposed to construct $\mathcal{M}$, where usually two goals compete: On the one hand, $\mathcal{M}$ should contain a minimal number of elements. On the other hand, one aims for linear costs with respect to the cardinality of $\mathcal{T}$. Unlike expected in the literature [2], we formulate and analyze an algorithm, which constructs a minimal set $\mathcal{M}$ at linear costs. In particular, Dörfler marking with minimal cardinality is a linear complexity problem.

References

[1] W. Dörfler, *SIAM Journal on Numerical Analysis* **33(3)** (1996), pp. 1106–1124.

[2] R. Stevenson, *Foundations of Computational Mathematics* **7(2)** (2007), pp. 245–269.