New counterexamples concerning Lusin (N) condition

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We present three new results in the field of Lusin (N) condition. Firstly, we ask if there is a Sobolev function, such that its gradient is continuous, belongs to $W^{1,n}((-1,1)^n,(-1,1)^n)$ and violates the Lusin (N) condition. We present such a gradient mapping.
In the second part we present the characterisation of the guarantee of the Lusin (N) condition for Sobolev mappings and homeomorphisms. We show that the Lusin (N) condition may fail for a mapping or even a homeomorphism in $W^{k,p}$ for $p < \frac{n}{k}$. That is well-known only in case $k = 1$. We also show the behaviour of the limiting case $W^{k,\frac{n}{k}}$ for both mappings and homeomorphisms and we show the positive proofs for $p > \frac{n}{k}$.

References

[1] T.Roskovec, *Construction of $W^{2,n}(\Omega)$ function with gradient violating Lusin (N) condition*, Math. Nachr. **289**, No. **8–9**, 2016, 1100–1111.

[2] T.Roskovec, *Sobolev homeomorphism in $W^{k,p}$ and the Lusin (N) condition*, Submitted.