REFERENCES

1. G. Brauer, Research Problem: *Sets of convergence of exponential series*, Bull. Amer. Math. Soc. **72** (1966), p. 470.
2. L. Gillman and M. Jerison, *Rings of continuous functions*, Van Nostrand, New York, 1960.
3. N. Dunford and J. T. Schwartz, *Linear operators*. I, Interscience, New York, 1958.
4. V. M. Darevsky, *On intrinsically perfect methods of summation*, Bull. Acad. Sci. URSS Ser. Mat. (Izv. Akad. Nauk SSSR Ser. Mat.) **10** (1946), 97–104.

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THE UNION OF FLAT $(n-1)$-BALLS IS FLAT IN R^n

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THEOREM.[2] *Let β_1^{n-1} and β_2^{n-1} be two locally flat $(n-1)$-balls in R^n with $\beta_1 \cap \beta_2 = \partial\beta_1 \cap \partial\beta_2 = \beta^{n-2}$, where β^{n-2} is an $(n-2)$-ball which is locally flat in $\partial\beta_1$ and $\partial\beta_2$. Then $\beta_1 \cup \beta_2$ is a flat $(n-1)$-ball in R^n.*

This result has been announced by Černavskiĭ [**1**], but only for $n \geqq 5$ since his outlined proof uses engulfing. Our proof avoids engulfing and works for all n; a thorough knowledge of Cantrell and Lacher's version (see [**2**, §§4 and 5]) of Černavskiĭ's theorem is necessary to understand our proof.

We also have another proof of the following corollary which appears in [**4**].

COROLLARY. *Let $g: M^{n-1} \rightarrow N^n$ be an imbedding of an $(n-1)$-manifold into an n-manifold which is locally flat except on a set E. If $n > 3$, then E contains no isolated points (see [**3**] for the same result when M and N are spheres).*

PROOF. Let C be a neighborhood of an isolated point p in M which is homeomorphic to an $(n-1)$-ball, with g locally flat on $C-p$. Then split C into $(n-1)$-balls C_1 and C_2 so that $C = C_1 \cup C_2$ and $C_1 \cap C_2$ is an $(n-2)$-ball containing p. g is locally flat on C_1 and C_2 except at the point p on their boundaries. Then, since $n > 3$, g is flat on all of C_1 and C_2 by [**5**]. It follows from the theorem that $C_1 \cup C_2 = C$ is flat, so E has no isolated points.

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[2] *Added in proof.* Černavskiĭ has independently proven this theorem by similar methods.