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CONTINUA IN THE STONE-CECH REMAINDER OF R^2

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In this paper it is shown that $\beta R^2 - R^2$ contains 2^c nonhomeomorphic continua. This extends the result already known for dimension three and greater.

Introduction. In [5], it is shown that for $n \geqq 3$, there are 2^c nonhomeomorphic continua in $\beta R^n - R^n$. The proof involves embedding solenoids in R^3, and hence does not work for the cases $n = 1, 2$. In this paper, we prove that $\beta R^2 - R^2$ also contains 2^c nonhomeomorphic subcontinua. While this implies the result for $(n) \geqq 3$, the construction in [5] also exhibits c continua in $\beta R^3 - R^3$ with nonisomorphic first Cech cohomology groups, and 2^c compacta in $\beta R^3 - R^3$, no two of which have the same shape. Also, it seems reasonable that the continua constructed in $\beta R^3 - R^3$ may be shown to have different shapes, or even nonisomorphic first Cech cohomology groups. In the case of $\beta R^2 - R^2$, it seems unlikely that any additional shape-theoretic results can be obtained with this construction. The case $n = 1$ is yet unsolved.

Preliminaries. Let βX denote the Stone-Cech compactification of a space X. For references, see Gillman and Jerison [1], or Walker [4]. The Stone-Cech remainder of X, $\beta X - X$, will be denoted by X^*. Note that the remainder of a closed subset of R^n is contained in $\beta R^n - R^n$. Also, the image under a rotation of R^2 of a set in R^2 of the form $\{(x, y): x \geqq 0,\ \alpha \leqq y \leqq \gamma; \alpha,\ \gamma \in R\}$ will be called a thickened ray.

Main result.

THEOREM. *There are 2^c nonhomeomorphic continua in $\beta R^2 - R^2$.*

Proof. For the sake of clarity, we consider first the construction of c nonhomeomorphic continua in $\beta R^2 - R^2$. We will then apply these arguments and results in the construction of 2^c nonhomeomorphic continua in $\beta R^2 - R^2$.

Consider a collection $\{P_a: a \in \mathscr{A}\}$ where each P_a is an infinite subset of positive integers; for $a \neq b$, either $P_a - P_b \neq \emptyset$ or $P_b - P_a \neq \emptyset$; and $\operatorname{card}\mathscr{A} = c$. For $p \in P_a$, consider the two rays $\{(x, y): x \geqq 0,\ y = 1/p\}$ and $\{(x, y): x \geqq 0,\ y = 1/(p + 1)\}$. Between these rays, consider p disjoint thickened rays, say $T_a(p, n)$, where $n = 1, 2, \cdots, p$, and labeled so that if $n_1 < n_2$, the y-coordinate of