NAYATANI, Shin Professor

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Membership of academic societies:
Mathematical Society of Japan

Research Interest:

- Rigidity of discrete groups
- Conformal geometry

Research Summary:

My subject of study is geometry. I learned differential geometry when I was a student, and since then I have studied topics in differential geometry and those related to geometry. In past, I studied the instability index of minimal surfaces, scalar curvature equations, geometric structures associated with real and complex Kleinian groups, self-dual metrics, CR geometry and quaternionic CR geometry. The key words for them will be surface geometry, geometric analysis and conformal geometry.

My recent research is on the actions of discrete groups (that is, infinite countable groups) on spaces. It is supposed that the spaces have metrics and the actions preserve them. The prototype of such situation is the action of the fundamental group of a Riemannian manifold on its universal covering space. In such a case, the action is good in the sense that it is properly discontinuous. We consider actions of more general discrete groups on more general metric spaces, but the metric spaces are not completely arbitrary; they will be assumed to be similar to Riemannian manifolds of nonpositive sectinal curvature. In this setting, according to the choices of discrete groups and metric spaces, it can happen that good actions are extremely rare or never exist. Such discrete groups are known to have very special algebraic property, but it has not been understood very well whether such groups (in particular, having also the property of so-called hyperbolicity) exist in abundance.

We could prove that such groups do exist in abundance by using methods with origin in differential geometry and geometric analysis (in particular, maps minimizing certain energy) and combining them with the theory of random groups. An interesting future problem is to construct such groups explicitly, instead of appealing to the random group theory.

The original motivation for this research was the following problem: Prove geometrically the Margulis superrigidity theorem, a rigidity theorem for lattices of certain algebraic groups, when the algebraic groups are the matrix groups with coefficients in p-adic numbers. The Margulis theorem can be formulated in the above setting, but a geometric proof is not yet completed. I'm working on this problem again, though I abandoned it for some time.

Major Publications:

[1] H. Izeki and S. Nayatani, Combinatorial harmonic maps and discrete-group actions on Hadamard spaces, Geom. Dedicata **114** (2005), 147–188.

[2] S. Nayatani, Patterson-Sullivan measure and conformally flat metrics, Math. Z. **225** (1997), no. 1, 115–131.

Awards and Prizes:

- 2004, Geometry Prize.

Education and Appointments:

1990	JSPS Post-doctoral Fellow, Osaka University
1991	Research Associate, Tohoku University
1994	Associate Professor, Tohoku University
1998	Associate Professor, Nagoya University
2005	Professor, Nagoya University

Message to Prospective Students:

The themes of my seminar for master course students have been Riemannian goemetry and geometric analysis, geometry and analysis of groups, hyperbolic geometry, and so one. For details, please look at the past course designs (in Japanese) available at

`http://www.math.nagoya-u.ac.jp/ja/education/archive/`

In each year I propose a theme of the seminar, but the details are decided by discussing with the students. (They depend on the students' preliminary knowledge, interest and the future career.) The provisional purpose of the seminar will be to master the assigned theme through working with it for one or two years. The students, however, may shift to other topics in geometry if they get interested in them in the course of their study, as I consider it desireable to find the object of your interest by yourself.