

Bonnet, Pierre-Ossian | Encyclopedia.com

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(*b.* Montpellier, France, 22 December 1819; *d.* Paris, France, 22 June 1892)

mathematics.

Bonnet was the son of Pierre Bonnet, *commisbanquier*, and Magdelaine Messac. After attending the College of Montpellier, he in 1838 entered the École Polytechnique in Paris, where he studied at the École des Pontsw et des Chaussées. After graduation, however, he declined an engineering position, preferring teaching and research. In 1844 he became *répétiteur* at the École polytechnique, augmenting his income by private tutoring. In a paper of 1843 he published convergence criteria of series with positive terms, among them logarithmic criteria. Another paper on series was honored by the Brussels Academy of Sciences and was published in 1849. By that time Bonnet had, starting in 1844 with the paper “Sur quelques propriétés généraux des surfaces,” begun to publish that series of papers on differential geometry on which his fame is based. The merit of this work was recognized by the Académie des Sciences when it elected Bonnet to membership in 1862 to replace Biot.

In 1868 Bonnet became Michel Charles’s *suppléant* at the École Polytechnique in the latter’s course on higher geometry, and in 1871 he became director of studies there. He also taught at the École Normale Supérieure. In 1878 he obtained a chair at the Sorbonne, succeeding the astronomer Leverrier, and in 1883 he succeeded Liouville as a member of the Bureau des Longitudes. Married and the father of three sons, he always lived the quiet and unpretentious life of a scholar.

Bonnet’s favorite field was the differential geometry of curves and surfaces, a field opened by Euler, Monge, and Gauss, but at that time lacking systematic treatment and offering wide fields of research. Between 1840 and 1850 this challenge was taken up by Bonnet and a group of younger French mathematicians—Serret, Frenet, Bertrand, and Puiseux—but it was Bonnet who most consistently continued in this field. In the “Mémoire sur la théorie générale des surfaces,” presented in 1844 to the Académie, Bonnet introduced the concepts of geodesic curvature and torsion, and proved a series of theorems concerning them. One of these is the formula for the line integral of the geodesic curvature along a closed curve on a surface, known as the Gauss-Bonnet theorem (Gauss had published only a special case). Bonnet also showed the invariance of the geodesic curvature under bending of the surface.

From 1844 to 1867 Bonnet wrote a series of papers on differential geometry of surfaces. Special attention should be given to the “Mémoire sur la théorie des surfaces applicables sur une surface donnée” (1865–1867), written as a solution for a prize contest announced by the Académie in 1859: i.e., to find all surfaces of a given linear element. The problem is sometimes associated with Edouard Bour, who wrote a competing memoir (1862). The third entrant was Delfino Codazzi. Bonnet, in his contribution, showed the importance of certain formulas introduced in 1859 by Codazzi, formulas now taken as part of the so-called Gauss-Codazzi relations. He also showed the role these formulas play in the existence theorem for surfaces, if first and second fundamental forms are given. Bour, in his paper, came to similar conclusions.

In these and other papers Bonnet stressed the usefulness of special coordinate systems on a surface, such as isothermic and tangential coordinates; studied special curves, such as lines of curvature with constant geodesic curvature (1867); and investigated the conditions under which geodesic lines are the shortest connection between two points on a surface. He also paid much attention to minimal surfaces—for instance, those applicable on each other—and surfaces of constant total and constant mean curvature (1853).

Bonnet also published works on geodesy and cartography, theory of series (convergence criteria), algebra, rational mechanics, and mathematical physics. In 1871 he gave a definition of the limit for functions of a real variable.

BIBLIOGRAPHY

I. Original Works. Among Bonnet’s papers are “Note sur la convergence et divergence des séries.” in *Journal de mathématiques pures et appliquées* **8** (1843), 73–109; “Sur quelques propriétés générales des surfaces et des lignes tracées sur les surfaces,” in *Comptes rendus de l’Académie des Sciences*, **14** (1844); “Mémoire sur la théorie générale des surfaces,” in *Journal de l’École Polytechnique*, **32** (1848), 1–46; “Sur la théorie des séries,” in *Mémoires couronnés de l’Académie de Bruxelles*, **22** (1849); *Mémoire sur couronnés de l’Académie de Bruxelles*, **22** (1849); “Mémoire sur l’emploi d’un nouveau système de variables dans l’étude des propriétés des surfaces courbes,” in *Journal de mathématiques pures et appliquées*, ser. 2, **5** (1860), 153–266; and “Mémoire sur la théorie des surfaces applicables sur une surface donnée,” in *Journal de l’École Polytechnique*, **41** (1865), 201–230, and **42** (1867), 1–151.

Bonnet's most important papers are mainly in the *Journal de l'École Polytechnique*, the *Journal de mathématiques pures et appliquées*, and the *Comptes rendus de l'Académie des Sciences*. He also wrote a *Mécanique élémentaire* (Paris, 1858). Bonnet's papers have never been collected, but the essence of his work on the theory of surfaces can be found in Gaston Darboux's *Leçons sur la théorie générale des surfaces*, 4 vols. (Paris, 1887–1896). *passim*.

II. Secondary Literature. Works on Bonnet are P. Appell, "Notice sur la vie et les travaux de Pierre Ossian Bonnet" in *Comptes rendus de l'Académie des Sciences*, **117** (1893), 1013–1024; Michel Charles, *Rapport sur les progrès de la géométrie en France* (Paris, 1870), pp. 199–214; and A. Franceschini, "Bonnet," in *Dictionnaire de biographie française*. Vol. VI (Paris, 1954).

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