Hiroshi OKAMURA

By

Toshizô Matsumoto

September 3, 1948 the sudden death of Prof. Okamura aston-
ished us. It was the next morning of the day he left hospital after
the permission of the doctor. At that time in our Institute he
was charged with the third chair of mathematics (differential and
integral calculus, theory of functions of real variables) which the
present writer had formerly assigned to him. Okamura, as his
follower, would have witten the note for him. But a curious des-
tiny overturned the rôle. In the following I would like to speak
shortly about his researches on the uniqueness of the solution of
the differential equation of the first order.

Hiroshi Okamura was born in Kyoto September 10, 1905 as
a son of Tsukasa Okamura, who was the professor of the chair
of the civil law in the Department of Law of our University. He
finished March, 1929 the course of three years of the higher
mathematics of our Department of Science with a brilliant career.
Next month he was charged as a lecturer. He said he had a
particular interest in course of my lecture for Picard's successive
approximation of differential equations. By this reason I proposed
to him, pursuing somewhat Picard's method, to search the necessary
and sufficient condition for the unique existence of the integral of
the differential equation of the first order. At that time in our
country, after Perron and Yoshie, several sufficient conditions for
the uniqueness were found by many mathematicians. I offered to
him all of the literatures I had. Thus his first paper appeared
March 1931, in our Memoirs of the College of Science, much
influenced by Caratheodory's function theory of real variables
which I was derivering in the seminary.

After his second paper one day he came to me to tell that
his task seemed to have been finished. Though his second paper
was very valuable, yet it was far from giving the necessary and

sufficient condition for the unique existence of the integral; so I derivered in the seminary (January 31, 1934) a long review on this subject. In this lecture (its manuscript is yet in my hand), to stimulate him I took an attitude as if I would dare to solve this problem by myself. In the summer his third paper appeared with a brilliant theorem of a necessary and sufficient condition which we awaited long. At the end of his paper he thanked me about my seminary lecture though I don't recall, even at present, what point inspired him.

He was sent abroad February 1937 by the order of the Education Ministry for the research of the mathematics. He stayed almost in Paris and returned home April 1939. A little later his fourth paper appeared with a quite new concept of a kind of variation for the uniqueness problem. Neither he told nor I asked him how did he come to his imagination. Since he should survive me, I felt no need to do so at that time.

After his seventh paper he said that the researches for uniqueness were almost completed. His health was not good during the war time by the malnutrition. After the war he began to act. We see in this journal his last paper very remarkable yet incomplete in some points which have been completed by his followers. It will be read also in this volume.

On the other hand I have been directing Yoshizawa to pursue Okamura's researches on the differential equation. Yoshizawa and Hayashi together have greatly developed Okamura's idea; but alas! it was quite shortly after his death. Their paper will be read also in this volume.

List of Papers

*Numbers marked with * are written in Japanese.*

1. Sur l'approximation successive et l'unicité de la solution de $\frac{dy}{dx}$=f (x, y). (First paper) Mem. Coll. Sci., A, Vol. 14 (1931).
2. Recherches sur le degré de grandeur d'une certaine intégral définie contenant un paramètre; leurs applications aux series entières et a l'equation différentielle ordinaire. (Second paper) Ibid, Vol. 15 (1932).
3. Sur les coefficients de series de Taylor des fonctions entières d'ordre fini. Tohoku Math. Jour., Vol. 38 (1932).
4. Sur l'unicité de la solution de $\frac{dy}{dx}$=f(x,y). (Third paper) Mem. Coll. Sci., A, Vol. 17 (1934).
5.* Relation between M(r) and m(r). Mathematics, monthly edited, Sept., 1936.

6. Sur la croissance des series entières. Mem. Coll. Sci., A, Vol. 19 (1936).

7. Applications de la méthode d'approximations successives aux équations intégrales de Volterra singulières. Ibid, Vol. 20 (1937).

8. Sur certaines équations de Volterra singulières. Ibid, Vol. 22 (1939).

9.* Borel set in the space of countably infinite many dimensions. Topology, Vol. 2 (1939).

10. Sur l'unicité des solutions d'un système d'équations différentielles ordinaires. (Fourth paper), Mem. Coll. Sci., A, Vol. 23 (I940).

11.* On $y'' = f(x,y,y')$. Func. Eq., No. 27 (1941).

12. Condition necessaire et suffisante remplie par les équations différentielles ordinaires sans points de Peano. (Fifth paper) Mem. Coll. Sci., A, Vol. 34 (1941).

13.* On the uniqueness of the solutions of the ordinary differential equations, II. Func. Eq.. No. 28 (1941).

14.* On the existence theorem of Cauchy-Kovalewski-Nagumo's initial condition problem of partial differential equations. Ibid, No. 29 (1941).

15.* On $y'' = f(x,y,y')$, II. Ibid, No. 30 (1941).

16.* On $y'' = f(x,y,y')$, III. Ibid, No. 31 (1942).

17.* On the ordinary differential equations with continuable solutions. Ibid, No. 32 (1942).

18.* On plane family and its normal section lines (parallel curves). Ibid, No. 34 (1942).

19.* On the singular points of ordinary differential equations and Emden-Fowler's equation. Ibid, Vol. 35 (1942).

20. Sur l'existence de solutions pour une équation différentielle ordinaire. (Sixth paper) Mem. Coll. Sci., A, Vol. 24 (1942).

21.* On the theorem of Cauchy-Kowalewski-Nagumo. Func. Eq., No. 36 (1942).

22.* A remark about the ordinary differential equations without Peano's points. Ibid. No. 37 (1943).

23. Sur une sorte de distance relative a un systeme différentielle. (Seventh paper) Proc. Phy-Math. Soci. Japan, III, Vol. 25 (1943).

24.* On the strong stability of rest points of flow. Func. Eq., No. 40 (1943).

25.* Stability condition of the solutions of the ordinary differential equations. Ibid, No. 41 (1943).

26.* On the second mean value theorem of integral. Mathematics, edited by the Math. Soc., Vol. 1 (1947).

27.* On Kuroda's essay. Fund. Sci., Vol. 2 (1948).

28.* On the theory of Fredholm's integral equations. Mathematics, edited by the Math. Soc., Vol. 1 (1949).

29.* On the surface integral and Gauss-Green's theorem. Ibid, Vol. 2 (1950).

30. The same subject in this volume.