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Peramalan Permintaan Oli Dengan Integrasi Support Vector Regression (SVR) Dan Particle Swarm Optimization (PSO)

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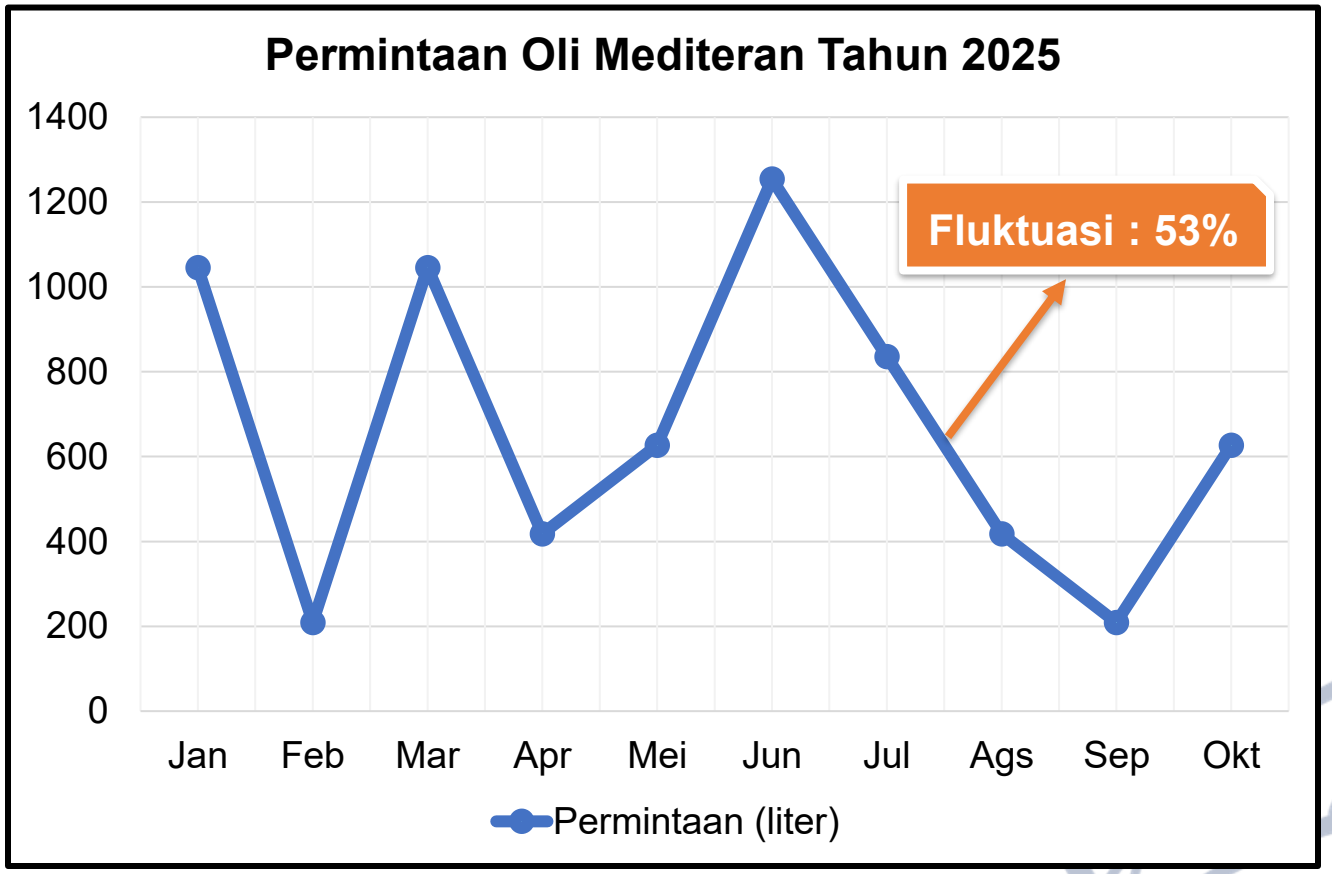
Pendahuluan

Gudang Spare Part dan Consumable Part

Belum Diterapkan Sistem
Stok Aman (*Safety Stock*) Pada Oli

Alasan : Jumlah permintaan oli tidak menentu (fluktuatif)

Solusi : Peramalan (*forecasting*)

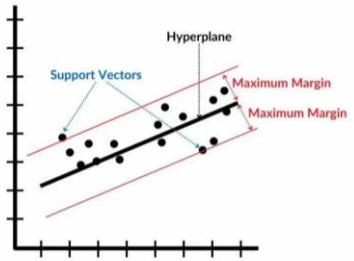


Rumusan Masalah

- Berapa **kuantitas** permintaan oli pada periode berikutnya?
- Bagaimana cara menghasilkan peramalan dengan tingkat **kesalahan (*error*) minimum**?

Metode

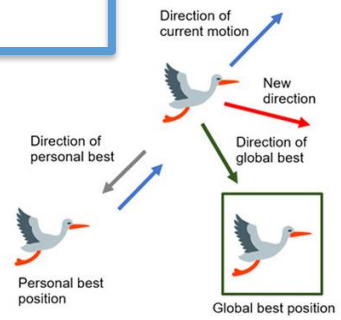
Membangun **model prediksi** dari data non-linier



Support Vector Regression (SVR)

Particle Swarm Optimization (PSO)

Mencari **parameter terbaik** agar SVR bekerja dengan optimal



Pembahasan

Inisialisasi Partikel Awal

X	C	ε	σ	cLR	λ	F1	F2	F3
1	328,3279	0,0399	5,5198	1,7243	0,6502	1	1	0
2	961,2476	0,0133	2,0424	3,9132	0,3644	0	1	1
3	849,0079	0,0564	2,2829	2,2771	1,5674	1	1	0

Hasil Prediksi Awal

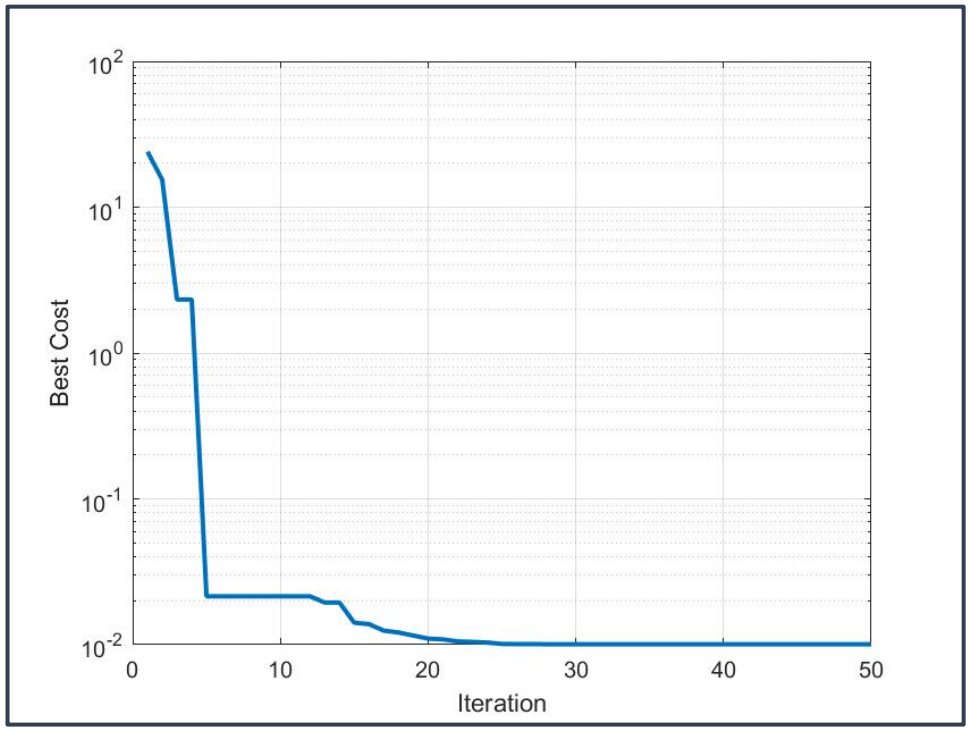
Uji	F(x)	Denormalisasi	Aktual
1	14,8774	2549,144	159
2	14,9088	2554,226	206
3	14,9008	2552,929	193
4	14,9043	2553,500	258
5	14,9235	2556,603	168

Nilai Error Awal

Fold	Error
1	11,77
2	10,07
3	11,14
4	11,92
5	9,60
Cost	10,90

Nilai *error* tinggi:
Perlu dilakukan
optimasi parameter

Pembahasan



Grafik Optimasi PSO-MATLAB

Parameter Optimal PSO

X	C	ε	σ	cLR	λ
1	199,9993	0,0744	0,2487	0,1954	0,003

Nilai Cost Setelah Optimasi

gBest	Cost
1	24,03988
2	15,42977
3	2,32748
4	2,32748
5	0,02146
...	...
50	0,01006

Error Kecil

Selanjutnya parameter yang optimal ini **dapat digunakan** pada proses prediksi pada tahap berikutnya

Pembahasan

FOLD K = 1

Data Uji (Data *Testing*)

Indeks	F1	F2	F3	Aktual
0	0,9630	0,2099	0,2840	0,1235
1	0,2099	0,2840	0,1235	0,4136
2	0,2840	0,1235	0,4136	0,3333
…	…	…	…	…
9	0,9815	0,3519	0,7716	0,2222

Data Latih (Data *Training*)

Indeks	F1	F2	F3	Aktual
10	0,3519	0,7716	0,2222	0,0741
11	0,7716	0,2222	0,0741	0,2963
12	0,2222	0,0741	0,2963	1,0000
…	…	…	…	…
24	0,3580	0,6914	0,6667	0,3210

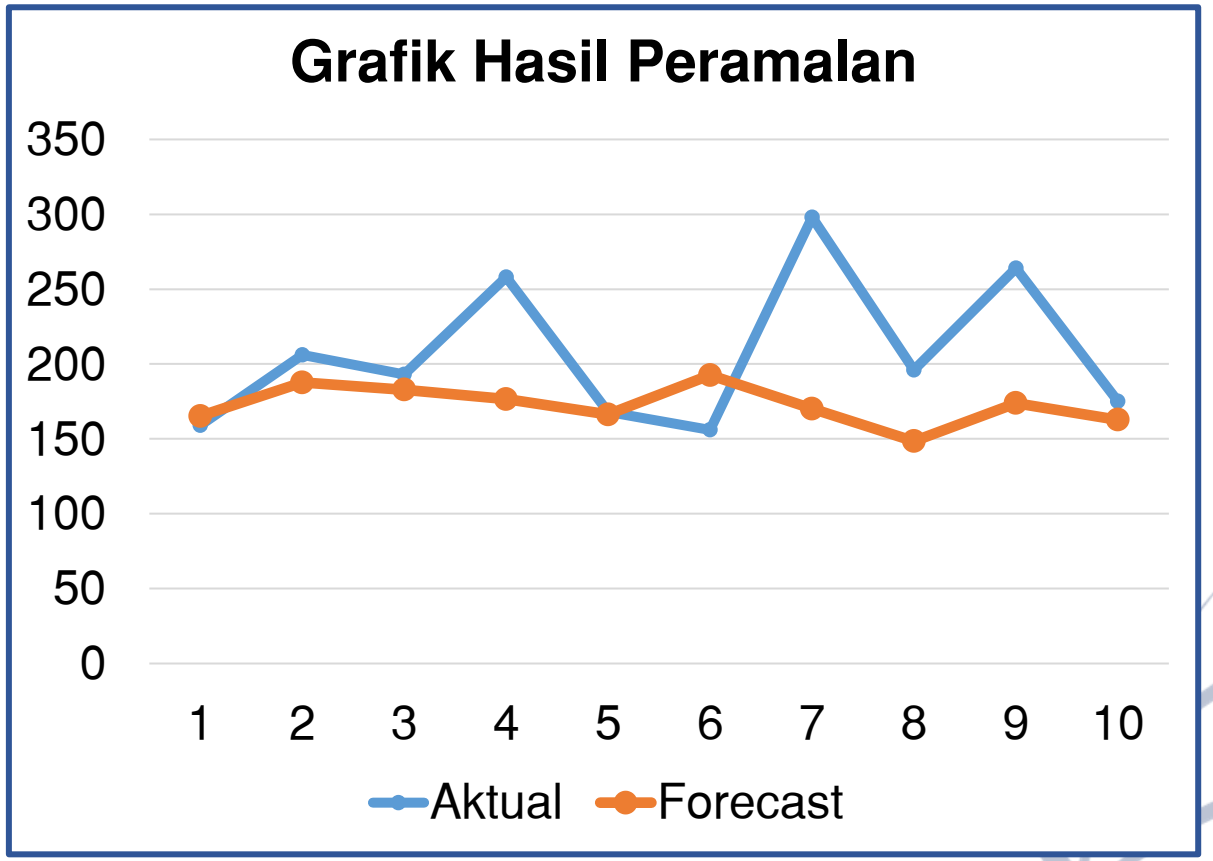
Matriks Kernel *Radial Basis Function* (RBF)

Uji/Latih	1	2	3	…	15
1	0,0474	0,5210	0,0118	…	0,0159
2	0,7852	0,0765	0,7845	…	0,0771
3	0,7166	0,0576	0,8676	…	0,5700
4	0,5936	0,0195	0,9140	…	0,2611
5	0,1162	0,0104	0,1574	…	0,9397
6	0,9823	0,1936	0,8098	…	0,1455
7	0,2738	0,9814	0,0891	…	0,0248
8	0,0074	0,0001	0,0222	…	0,3464
9	0,5333	0,0148	0,8727	…	0,2674
10	0,0035	0,0137	0,0015	…	0,0395

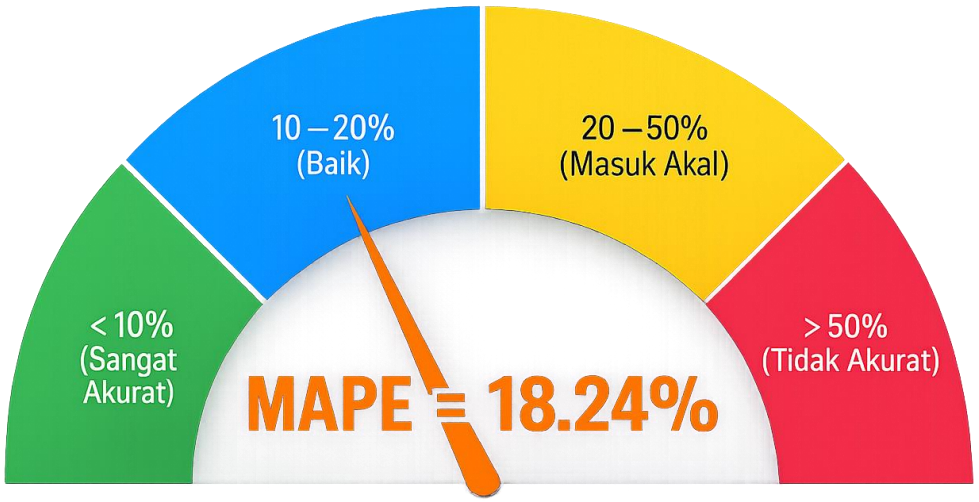
Hasil

Tabel Hasil Peramalan

Uji	Aktual	Forecast
1	159	165,19
2	206	187,67
3	193	182,87
4	258	176,59
5	168	166,27
6	156	192,61
7	298	170,15
8	196	148,46
9	264	173,84
10	175	162,74



Temuan Penting Penelitian



Interpretasi Lewis (1982)

MAPE

(Mean Absolute Percentage Error)

- Nilai akurasi hasil peramalan

$$\text{MAPE} = \left(\frac{100}{n}\right)\sum\left|A_t - \frac{F_t}{A_t}\right|$$

$$= \left(\frac{100}{10}\right)\left[\left|159 - \frac{165}{159}\right| + \ldots + \left|175 - \frac{163}{175}\right|\right]$$

$$= \mathbf{18{,}24\ \%}$$

Manfaat Penelitian

Penelitian ini memberikan manfaat bagi perusahaan sebagai **dasar pertimbangan** dalam menentukan tingkat stok aman (*safety stock*) dan jumlah pemesanan optimal oli guna mendukung pengelolaan persediaan yang lebih efektif dan efisien

Referensi

[1] R. N. Aini and E. Aryanny, "Policy Making in Optimizing Inventory Control with Continous and Periodic Review Method at PT . XYZ," *Prozima*, vol. 5, no. 2, pp. 93–99, 2021.

[2] A. H. Nasution and Y. Prasetyawan, *Perencanaan dan Pengendalian Produksi*. Yogyakarta: Graha Ilmu, 2008.

[3] R. K. Dash, T. N. Nguyen, K. Cengiz, and A. Sharma, "Fine-Tuned Support Vector Regression Model for Stock Predictions," *Neural Comput. Appl.*, vol. 35, no. 32, 2021 .

[4] W. Budiharto, *Machine Learning & Computational Intelligence*. Yogyakarta: CV Andi, 2016.

[5] A. B. Raharjo, Z. Z. Dinanto, D. Sunaryono, and D. Purwitasari, "Prediksi Akumulasi Kasus Terkonfirmasi Covid-19 Di Indonesia Menggunakan Support Vector Regression," *Techno.Com*, vol. 20, no. 3, pp. 372–381, 2021.

[6] B. Santosa, *Data Mining: Teknik Pemanfaatan Data Untuk Keperluan Bisnis*. Yogyakarta: Graha Ilmu, 2007.

[7] N. Afifah *et al.*, "Perbandingan Kinerja Kernel RBF dan Linear pada Algoritma Support Vector Machine (SVM) untuk Prediksi Serangan Ransomware Locker," vol. 15, no. 1, pp. 3118–3123, 2023.

[8] J. Zhu, J. Liu, Y. Chen, and X. Xue, "Binary Restructuring Particle Swarm Optimization and Its Application," vol. 2, no. 2, pp. 1–17, 2023.

[9] F. C. Angela and T. Sukmono, "Fusing SVR with PSO Improves E-commerce Sales Prediction with 8.98% MAPE," *Indones. J. Innov. Stud.*, vol. 25, no. 2, pp. 1–14, 2024.

[10] A. Umiyati, D. Dasari, and F. Agustina, "Peramalan Harga Batubara Acuan Menggunakan Metode PSOSVR dan IPSOSVR," *J. EurekaMatika*, vol. 9, no. 1, pp. 69–94, 2021.

Referensi

[11] M. R. Kusnaidi, T. Gulo, and S. Aripin, "Penerapan Normalisasi Data Dalam Mengelompokkan Data Mahasiswa Dengan Menggunakan Metode K-Means Untuk Menentukan Prioritas Bantuan Uang Kuliah Tunggal," *J. Comput. Syst. Informatics*, vol. 3, no. 4, pp. 330–338, 2022.

[12] A. Harmain, Paiman, H. Kurniawan, Kusrini, and D. Maulina, "Normalisasi Data Untuk Efisiensi K-Means Pada Pengelompokan Wilayah Berpotensi Kebakaran Hutan Dan Lahan Berdasarkan Sebaran Titik Panas," *TEKNIMEDIA*, vol. 2, no. 2, pp. 83–89, 2021.

[13] D. Haryadi, A. R. Hakim, D. M. U. Atmaja, and S. N. Yutia, "Implementation of Support Vector Regression for Polkadot Cryptocurrency Price Prediction," *Int. J. Informatics Vis.*, vol. 6, no. 1–2, pp. 201–207, 2022.

[14] Jagadish, *Essential Concepts and Techniques of AI & ML*. Bopal: AGPHBooks, 2024.

[15] A. I. Sakti, D. Y. Dalimunthe, and I. Fahria, "Implementasi Elm Menggunakan Sigmoid Biner Untuk Prediksi Harga Cabai Rawit Di Provinsi Kepulauan Bangka Belitung," *J. Ilm. Mat.*, vol. 13, no. 02, pp. 367–373, 2025.

[16] S. Herawati and N. Prastiti, "Implementasi Metode Long Short Term Memory Untuk Peramalan Pertumbuhan Jumlah UMKM," *J. Simantec*, vol. 12, no. 2, pp. 63–70, 2024.

[17] S. K. Wati, N. Imro'ah, and E. Sulistianingsih, "Peramalan Harga Penutupan Indeks Saham LQ45 Dengan Metode Generalized Regression Neural Network (GRNN)," *Bimaster*, vol. 14, no. 2, pp. 217–226, 2025.

Referensi

[18] P. Fiszeder and W. Orzeszko, "Covariance matrix forecasting using support vector regression," *Appl. Intell.*, vol. 51, pp. 7029–7042, 2021.

[19] Z. Liao, S. Dai, and T. Kuosmanen, "Convex Support Vector Regression," *Eur. J. Oper. Res.*, vol. 313, no. 3, pp. 858–870, 2024.

[20] S. I. Abba *et al.*, "Emerging Harris Hawks Optimization based load demand forecasting and optimal sizing of stand-alone hybrid renewable energy systems – A case study of Kano and Abuja , Nigeria," *Results Eng.*, vol. 12, no. 12, 2021.

[21] B. Musa, N. Yimen, S. I. Abba, H. H. Adun, and M. Dagbasi, "Multi-State Load Demand Forecasting Using Hybridized Support Vector Regression Integrated with Optimal Design of Off-Grid Energy Systems — A Metaheuristic Approach," *Processes*, vol. 9, no. 7, 2021.

[22] R. T. Gorji, S. M. Hosseini, A. A. Abdoos, and A. Ebadi, "A Hybrid Intelligent Method for Compensation of Current Transformers Saturation Based on PSO-SVR," *Period. Polytech. Electr. Eng. Comput. Sci.*, vol. 65, no. 1, pp. 53–61, 2021.

[23] A. M. Hadi, W. Witanti, and Melina, "Prediksi Pergerakan Harga Emas Menggunakan Metode Genetic Support Vector Regression," *J. Inform. Teknol. dan Sains*, vol. 6, no. 3, pp. 486–496, 2024.

[24] P. Zhang, S. Mei, C. Shi, R. Xie, Y. Zhuo, and Y. Wang, "Forecasting DO of the river-type reservoirs using input variable selection and machine learning techniques - taking Shuikou reservoir in the Minjiang River as an example," *Ecol. Indic.*, vol. 155, no. 6, 2023.

[25] C. Puspitasari, N. Rokhman, and Wahyono, "Prediction Of Ozone (O3) Values Using Support Vector Regression Method," *J. Inform. Polinema*, vol. 7, no. 4, pp. 81–88, 2021.

Referensi

[26] T. M. Shami, A. A. El-saleh, M. Alswaitti, Q. Al-Tashi, M. A. Summakieh, and S. Mirjalili, "Particle Swarm Optimization : A Comprehensive Survey," *IEEE Access*, vol. 10, pp. 10031–10061, 2022.

[27] J. B. E. Putry, A. T. Sasongko, and W. Hadikristanto, "Optimization of Decision Tree Using Particle Swarm Optimization for Credit Risk of KMG Bank DKI," *Indones. J. Mach. Learn. Comput. Sci.*, vol. 4, no. 4, pp. 1403–1410, 2024.

[28] B. N. Azmi, A. Hermawan, and D. Avianto, "Analisis Pengaruh Komposisi Data Training dan Data Testing pada Penggunaan PCA dan Algoritma Decision Tree untuk Klasifikasi Penderita Penyakit Liver," *J. Teknol. Inf. dan Multimed.*, vol. 4, no. 4, pp. 281–290, 2023.

[29] N. F. Fahrudin, K. R. Putra, S. Umaroh, and G. B. Lautan, "Influence of Data Scaling and Train / Test Split Ratios on LightGBM Efficacy for Obesity Rate Prediction," *Multimed. Artif. Intell. Netw. Database J.*, vol. 9, no. 2, pp. 220–234, 2024.

[30] A. P. Engelbrecht, *Computational Intelligence : An Introduction*. Chichester: John Wiley & Sons, Ltd, 2007.

[31] X. Jiang, Y. Yue, Y. Min, Q. Zhang, and X. Gui, "Particle Swarm Optimization with Multiple Adaptive Subswarms," *J. Phys. Conf. Ser.*, vol. 1757, 2021.

[32] Z. Ngabidin, A. Sanwidi, and E. R. Arini, "Implementasi Metode Double Exponential Smoothing Brown Untuk Meramalkan Jumlah Penduduk Miskin," vol. 11, no. 2, pp. 328–338, 2023.

[33] R. N. Puspita, "Perbandingan Metode Double Exponential Smoothing Dan Triple Exponential Smoothing Pada Peramalan Nilai Ekspor Di Indonesia," *Jembura J. Probab. Stat.*, vol. 3, no. 2, 2022.

[34] C. D. Lewis, *Industrial and Business Forecasting Methods*. Kent: Butterworth & Co, Ltd, 1982.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