KAWASAKI STEEL TECHNICAL REPORT
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Electrical Steel

Frequency Dependence of the Complex Initial Permeability of MnZn Ferrite

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Synopsis :
The higher the real part of the complex initial permeability μi'of MnZn ferrites is, the lower is the frequency

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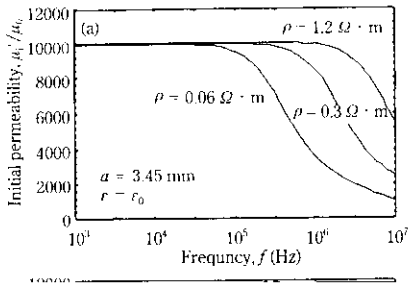
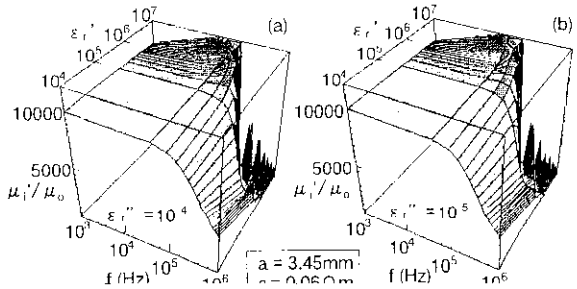
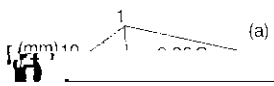
Synopsis:

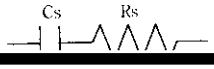
The higher the real part of the complex initial perme-

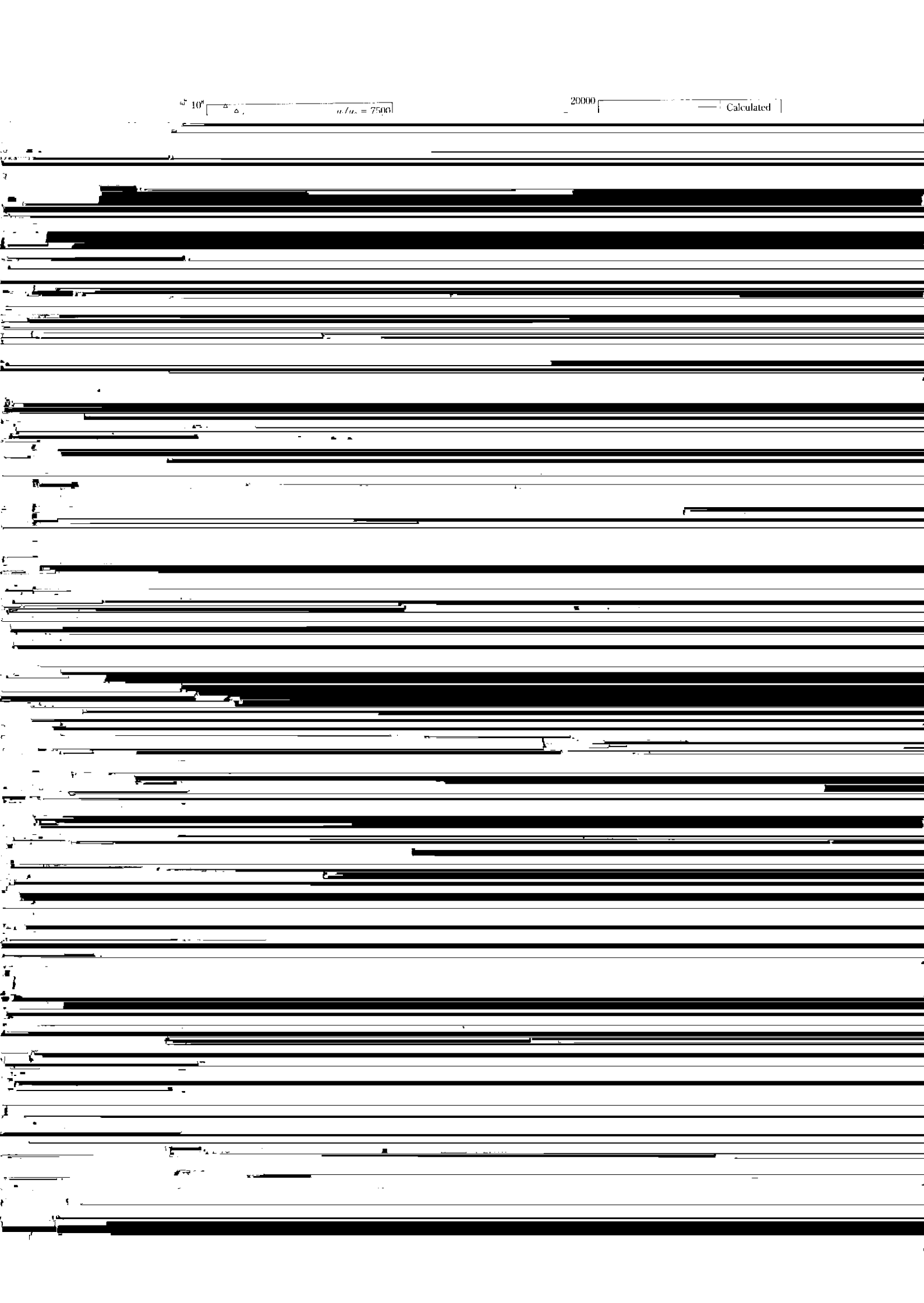
electromagnetically homogeneous medium (the permittivity ε, permeability μ, and resistivity ρ are constant in a DC or a low-frequency range), the spatial distribution of AC electromagnetic fields that propagate at a frequency and direct current. For metallic magnetic materials, resistivity is low and permittivity can be almost completely disregarded. In the case of polycrystalline MnZn ferrites that are ordinarily used, however,


(a)
ρ = 1.2 Ω · m
ρ = 0.06 Ω · m
ρ = 0.3 Ω · m
a = 3.45 mm
$\varepsilon_r = \varepsilon_0$
Initial permeability, μ_i'/μ_0
Frequncy, f (Hz)


(a)
(b)
ε_r'
μ_i'/μ_0
$\varepsilon_r'' = 10^4$
$\varepsilon_r'' = 10^5$
f (Hz)
a = 3.45mm


1
(a)

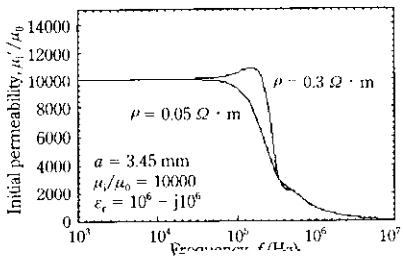

Cs
Rs


10^8
$u/u_* = 7500$
20000
Calculated

that the initial permeability of soft ferrites has a fre-

been clarified, the calculation is made by assuming the

In addition to relaxation due to eddy current losses, wall thickness to be 0.1 μm and 1 μm. In a case where μ



that determines the frequency dependence of complex initial permeability.

(3) The relaxation-type or resonance-type frequency dependence of complex initial permeability of MnZn ferrites can be derived from the electromagnetic behavior within a core if the dimensions, resistivity and permittivity of the core are taken into consideration; measured values can be reproduced well.