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Analysis of Small Microstrip Patch Antennas for Mobile Communication

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Abstract

This work presents the analysis and design of small microstrip patch antennas that can be used in mobile communication using Finite Difference Time Domain (FDTD) method. The formulation of the FDTD algorithm is described along with its fundamental properties. At the beginning, the method is applied to the arbitrary shaped patch; and the radio-electric properties of the considered microstrip patch antennas are formulated. The method is then applied to some known structure shapes working in high microwave frequency bands; the shapes include rectangular (dipole), annular-ring and semi-ring patches. Different feeding methods (Microstrip line feed and coaxial line feed) are used to energize the considered antennas. The input impedance (VSWR), the return loss, and the far field radiation patterns calculated with the aid of FDTD method and compared with the results obtained with the HFSS simulator.

Due to the nature of the chosen method, a new shape of patch is designed and analyzed. The new structure is named Berber-Z patch antenna taken from "TIFINAGH" Berber alphabet. The obtained results are Validated the HFSS simulator.

تصميم وتحليل هوائيات الشرائح الصغيرة للاتصالات المتنقلة

ملخص

هذا العمل يقدم تحليلا وتصميم هوائيات الشرائح الصغيرة التي يمكن استخدامها في الاتصالات المتنقلة باستخدام طريقة محدود فارق التوقيت المجال (FDTD). ويرد وصف لصياغة الخوارزمية (FDTD) مع خصائصه الأساسية. في البداية ، يتم تطبيق الطريقة لشرائح ذات ا شكال تعسفية ، وخصائص الراديو والكهرباء لشرائح الهوائيات الصغيرة. ثم يتم تطبيق هذه الطريقة على بعض الأشكال المعروفة هيكل العاملة في نطاقات التردد العالي الميكروويف ، وتشمل الشرائح الشكل المستطيل (ثنائي القطب) ، حلقية الدائري و نصف حلقية الدائري. وتستخدم أساليب مختلفة للتغذية و لتفعيل هوائيات (Microstrip سطر تغذية ومحوري خط تغذية) . مقاومة الإدخال (VSWR) ، وفقدان العودة ، والإشعاع مجال أنماط تحسب بمساعدة طريقة(FDTD) الأسلوب وبالمقارنة مع النتائج التي تم الحصول عليها باستخدام برنامج متطوريسمى محاكي التصميمات عالية التردد(HFSS).

ونظرا لطبيعة الطريقة المختارة، شكل جديد من الشرائح الهوائيات الصغيرات تم تصميمها وتحليلها. يدعى الهيكل الجديد البربرية التي اتخذت من "تيفيناغ الأبجدية البربرية"(البربر-Z). يتم التحقق من صحة النتائج التي تم الحصول عليها من جهاز(HFSS).

Résumé

Ce travail présente l'analyse et la conception de petites antennes micro-ruban patch qui peut être utilisé dans la communication mobile à l'aide 'Finite Difference Time Domain' (FDTD) méthode. La formulation de l'algorithme FDTD est décrite avec ses propriétés fondamentales. Au début, la méthode est appliquée à la pièce en forme arbitraire, et les propriétés radioélectriques de la micro-ruban antennes patch considérée sont formulées. La méthode est ensuite appliquée à une structure connue des formes de travail dans les bandes de fréquence micro-ondes de haute; les formes sont rectangulaires (dipôle), annulaires cycliques et le correctif semi-anneau. Différentes méthodes d'alimentation (ligne micro-ruban et ligne coaxiale) sont utilisées pour alimenter les antennes en considération. L'impédance d'entrée (VSWR), la perte de retour, et les modèles jusqu'à un champ de rayonnement calculées à l'aide de la méthode FDTD et comparés avec les résultats obtenus avec le simulateur HFSS.

En raison de la nature de la méthode choisie, une nouvelle forme de patch est conçue et analysé. La nouvelle structure porte le nom berbère antenne patch-Z extrait de "Tifinagh" alphabet berbère. Les résultats obtenus sont validés le simulateur HFSS.

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